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CORRECTIONS

Volume 42, January 1940, page 62, 2d line from bottom, Yellowstone Park, elevation should be "9,341".
Volume 42, September 1940, page 264, Upper Mississippi Valley and Missouri Valley sections, use revised figures on page 91 of this Review.

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A SLIDE RULE FOR DETERMINING 10,000-FOOT PRESSURE

By J. R. FULKS* and R. A. DIGHTMAN

[Weather Bureau Airport station, Seattle, Wash., March 1940]

One of the many problems confronting meteorologists engaged in airway forecasting arises from the frequent lack, during adverse weather, of current wind-aloft data. It is during such periods that accurate data concerning upper-air circulation are most important in properly planning instrument flights.

Some excellent work has recently been done by Vernon and Ashburn,¹ and by Haynes² on methods of computing winds aloft when actual observations are missing.

It is felt that the method now employed at the Seattle Airport Station of the Weather Bureau may be used to advantage in regions where there is a scarcity of reports of winds and/or pressures aloft, and in particular, when there is a limited amount of time available for such determinations.

At Seattle a chart of 10,000-foot pressures is constructed daily for the United States, western Canada, Alaska, and, as far as ship reports are available, the section of the Pacific Ocean adjoining the Pacific coast.

A network of radiosonde observations is available from the United States and Alaska, and an airplane sounding is received from Edmonton, Alberta, Canada. These reports do not normally provide sufficient information for construction of an accurate upper-air map along the immediate Pacific coast line, and particularly between Seattle and Juneau.

In order to provide a close network of pressure values, it has been the practice at Seattle during the past two years to estimate upper-air temperatures at a number of coastal and Canadian stations and ships in the adjacent Pacific Ocean, and use the reported sea-level pressures to obtain the 10,000-foot pressures.

The pressure reduction may be accomplished by means of various tables available; however, it is the purpose of this paper to describe the construction of a simple slide rule which is found very convenient for the purpose.

The hypsometric equation may be written:

$$z = \frac{RT_v}{Mg} \log_{10} \frac{P_0}{P} \quad (1)$$

where:

z = Difference of height, in centimeters, between upper and lower station.

$R = 2.8703 \times 10^6$.

T_v = Absolute virtual temperature (centigrade).

$= (1 + .605q) T = \left(1 + \frac{.376e}{P}\right) T$, Approx.

in which q = Specific humidity, $\frac{0.6221e}{P - 38e}$, e = Vapor pres-

sure, mb., and T = Absolute centigrade temperature. M = Modulus of common logarithms = 0.434294. g = Acceleration of gravity, c.g.s. units, average value (with respect to height) between upper and lower levels. P_0 = Pressure at lower level measured in any units, provided P_0 and P are in same units; P_0 will here be used for sea-level pressure. P = Pressure at higher level.

If, instead of constructing our pressure map for a surface of equal geometric height, we construct it for a surface of equal geopotential, the gradient or geostrophic wind equations for motion within this surface will apply more exactly. By definition it is only within a surface of equal geopotential that no work is done against gravity, since the average value of gravity from sea-level up to the surface of equal geopotential will always be the same.

With g and z defined exactly as in the hypsometric equation, and the lower point taken at sea-level, geopotential may be defined as follows:³ geopotential = gz , (g = average value).

We may express geopotential in terms of dynamic meters, defined (after V. Bjerknes) as

$$Z_d = \text{height, dynamic meters} = Z \frac{g(\text{average})}{1,000}$$

where Z = height, geometric meters.

In radiosonde observational work, the Weather Bureau uses as a unit of height 0.98 dynamic meter, which is equivalent to exactly 1 geometric meter when average $g = 980$ dynes.

To adopt a unit of 0.98 dynamic meter, it is merely necessary to substitute a value of 980 for g in the hypsometric equation.

Substituting for R , M , and g , the hypsometric equation becomes:

$$\frac{Z_d}{.98} = Z \text{ (meters)} = 67.439 T_v \log_{10} \frac{P_0}{P} \quad (2)$$

At 10,000 feet (3,048 geometric meters),

$$\log P - \log P_0 = -\frac{1}{.022126 T_v} \quad (3)$$

Since the average value of gravity from sea-level to 10,000 feet = 980 dynes at approximately $38^\circ 35'$ latitude, the surface will be exactly 10,000 geometric feet (3,048 meters) at this latitude. Geometric height will be less toward the Poles and greater toward the Equator.

From an inspection of equation (3) it is evident that, if $\log P$ and $\log P_0$ are plotted on the same logarithmic scale, the difference between any two corresponding

³ See for instance, *Smithsonian Meteorological Tables*, Fifth Revised Edition, pp. LIII-LV.

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¹ Vernon, Edward M., and Ashburn, Edward V. A practical method for computing winds aloft from pressure and temperature fields. MONTHLY WEATHER REVIEW, September 1938, 66: 267-274.

² Haynes, B. C. Upper-wind forecasting. MONTHLY WEATHER REVIEW, January 1938, 66: 4-6.

values of $\log P$ and $\log P_0$, as measured linearly along the scale, will be a function of T_s only. For any given value of T_s , the difference $\log P - \log P_0$ will be constant.

However, a plot of P and P_0 on an extended log scale would either be inconveniently long, or the consecutive values of pressure too crowded for practical use. The following arbitrary changes reduce the scale to a practical size, using inches for linear measure:

$$(100 \log P - 277) - (100 \log P_0 - 300) = 23 - \frac{100}{.022126 T_s} \quad (4)$$

Suppose we label the terms as follows:

"A" scale = $100 \log P_0 - 300$,

"B" scale = $100 \log P - 277$,

"C" scale = $23 - \frac{100}{.022126 T_s}$.

Arbitrary changes made in the equation above give the "A" and "B" scales a common zero point at 1,000 mb. on the "A" scale. The "A" and "B" scales are measured to the right, for convenience, of the common zero point along the same straight line, except that, on the "A" scale, values of pressure below 1,000 mb. are negative, and must be measured to the left.

The "A" and "B" scales constitute the stationary part of the rule. The "C" scale is the sliding portion, and is measured to the right of its own zero point.

Equation (4) is in a form convenient for use with pressure measured in millibars, and linear distance along the scale in inches. If it is desired to use other units, corresponding changes may be made. With the units here used the rule will be about 14 inches long.

In tables 1, 2, 3, the values of the "A", "B", and "C" scales are given.

TABLE 1.—"A" scale, $A = 100 \log P_0 - 500$

[P_0 = sea-level pressure, mb.]

P_0	A	P_0	A	P_0	A
	Inches		Inches		Inches
948	-2.319	984	-0.700	1018	0.775
950	-2.228	986	-.612	1020	.860
952	-2.136	988	-.524	1022	.945
954	-2.045	990	-.436	1024	1.030
956	-1.954	992	-.349	1026	1.115
958	-1.863	994	-.261	1028	1.199
960	-1.773	996	-.174	1030	1.284
962	-1.682	998	-.087	1032	1.368
964	-1.592	1000	.000	1034	1.452
966	-1.502	1002	.087	1036	1.536
968	-1.412	1004	.173	1038	1.620
970	-1.323	1006	.260	1040	1.703
972	-1.233	1008	.346	1042	1.787
974	-1.144	1010	.432	1044	1.870
976	-1.055	1012	.518	1046	1.953
978	-.966	1014	.604	1048	2.036
980	-.877	1016	.689	1050	2.109
982	-.789				

TABLE 2.—"B" scale, $B = 100 \log P - 277$

[P = pressure at 10,000 feet, mb.]

P	B	P	B	P	B
	Inches		Inches		Inches
622	2.379	666	5.347	710	8.126
624	2.518	668	5.478	712	8.248
626	2.657	670	5.607	714	8.370
628	2.795	672	5.737	716	8.491
630	2.934	674	5.865	718	8.612
632	3.072	676	5.995	720	8.733
634	3.209	678	6.123	722	8.854
636	3.346	680	6.251	724	8.974
638	3.482	682	6.378	726	9.094
640	3.618	684	6.506	728	9.213
642	3.754	686	6.632	730	9.332
644	3.889	688	6.759	732	9.451
646	4.023	690	6.885	734	9.570
648	4.158	692	7.011	736	9.688
650	4.291	694	7.136	738	9.806
652	4.425	696	7.261	740	9.923
654	4.558	698	7.386	742	10.040
656	4.690	700	7.510	744	10.157
658	4.823	702	7.634	746	10.274
660	4.954	704	7.757	748	10.390
662	5.086	706	7.880	750	10.506
664	5.217	708	8.003		

TABLE 3.—"C" scale, $C = 23 - \frac{100}{.022126 T_s}$

T_s	°C.	"C"	T_s	°C.	"C"	T_s	°C.	"C"
		Inches			Inches			Inches
233	-40	3.603	257	-16	5.414	281	8	6.916
234	-39	3.686	258	-15	5.482	282	9	6.973
235	-38	3.768	259	-14	5.550	283	10	7.030
236	-37	3.849	260	-13	5.617	284	11	7.086
237	-36	3.930	261	-12	5.684	285	12	7.141
238	-35	4.010	262	-11	5.750	286	13	7.197
239	-34	4.090	263	-10	5.815	287	14	7.252
240	-33	4.168	264	-9	5.880	288	15	7.307
241	-32	4.247	265	-8	5.945	289	16	7.361
242	-31	4.324	266	-7	6.009	290	17	7.415
243	-30	4.401	267	-6	6.073	291	18	7.469
244	-29	4.477	268	-5	6.136	292	19	7.522
245	-28	4.553	269	-4	6.198	293	20	7.575
246	-27	4.628	270	-3	6.261	294	21	7.627
247	-26	4.702	271	-2	6.323	295	22	7.679
248	-25	4.776	272	-1	6.384	296	23	7.731
249	-24	4.849	273	0	6.445	297	24	7.783
250	-23	4.922	274	1	6.505	298	25	7.834
251	-22	4.994	275	2	6.565	299	26	7.884
252	-21	5.065	276	3	6.625	300	27	7.934
253	-20	5.136	277	4	6.684	301	28	7.984
254	-19	5.206	278	5	6.742	302	29	8.034
255	-18	5.276	279	6	6.801	303	30	8.084
256	-17	5.345	280	7	6.859			

The accompanying diagram (fig. 1) illustrates the rule. The 10,000-foot pressure calculations are made thereon simply by setting the zero point of the "C" scale on the sea-level pressure, and reading the 10,000-foot pressure opposite the determined mean virtual temperature.

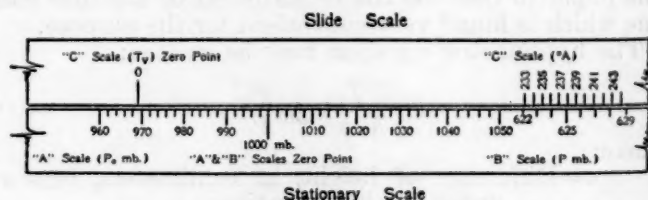


FIGURE 1.—Plan of 10,000-foot slide rule.

In preparing a pressure map it is of course necessary to estimate upper-air temperatures where they are not available from actual observations. This might at first appear difficult. However, surface temperature serves as a starting point for the estimated curve. A careful study of the meteorological factors involved, particularly the history and trajectory of air masses will give a fair picture of temperature conditions aloft. It is especially necessary to check estimates against such actual temperatures as are available when a radiosonde observation falls within the same air mass. With experience, considerable accuracy is possible.

If the pressure map is extended to land areas of any considerable elevation, and the reductions are made from reported sea-level pressure, it becomes necessary in determining T_s to use a fictitious temperature for that portion of the 10,000-foot column which is below the level of the station. This fictitious value is the mean of the current surface temperature and that 12 hours previously. It is that used in reducing station pressure to sea level. On the assumption that reduction to sea level has been made exactly according to this temperature by means of the hypsometric equation, we may without appreciable error construct a temperature curve, which, from sea level to the station level follows the above fictitious temperature, and from the surface level to 10,000 feet, follows the estimated free-air temperatures. The mean

of this total curve, with a small correction for water vapor content, gives the value of T_s .

In areas north of Seattle, including the north Pacific, it is usually necessary to apply only slight corrections for moisture content, and as a result, the difference between virtual and actual temperature is small. Using

Hann's empirical vapor pressure equation $\left(\log \frac{e}{e_0} = \frac{-Z}{6200}\right)$,

the value of average vapor pressure for the 10,000-foot column becomes roughly 0.6 that of the surface vapor pressure. If the dew point is 5°C . (a representative winter value in the north Pacific), the difference between T and T_s is about 0.6°C . (T_s higher than T). In summer the difference may be as much as 1.0°C . or slightly higher. In more southerly latitudes, $T_s - T$ is often considerably greater.

It is recognized that, at times, noticeable error may result in the above pressure determinations where it is difficult to estimate temperatures, but such errors will usually smooth out in drawing isobars on the pressure map. Experience at Seattle in the use of maps so constructed indicates that quite accurate average values of upper winds may be determined from them.

Acknowledgment is due L. P. Harrison of the Weather Bureau Aerological Division for helpful suggestions.

AN UNUSUAL HALO DISPLAY

By D. B. O. SAVILE

[Control Experimental Farm, Department of Agriculture, Ottawa, Ontario, February 1941]

Most of the individual arcs, halos, and parhelia that are associated with an abundance of ice crystals in the atmosphere are not so rare as to merit repeated description, but highly complex displays are far from common. For this reason, and because it seems to throw some light on the precise cause of the sun pillar, the display witnessed at Ottawa, Canada, on January 27, 1941, is worthy of record.

The common 22° halo started to develop before the sun was 3° above the horizon, and was almost continuously distinguishable until sunset. About 10 a. m., E. S. T., the 46° halo became faintly visible to eyes fully adapted to bright light. By 2 p. m. both halos, the horizontal parhelic circle, and the 22° parhelia were all well defined. Developments were then watched from open ground, and notes were taken for some time. During the next hour there were frequent variations in the intensity and extent of some of the components, but those shown in figure 1, and described below, were several times simultaneously visible at approximately 2.30 p. m.

The horizontal parhelic circle, LSM, generally extending about 30° beyond the point of intersection with the 46° halo; occasionally slightly exceeding a semicircle in extent.

The sun pillar, UV, frequently extending about 8° above and below the sun; maximum extent about 10° above and 12° below the sun; scarcely wider at the extremities than at the sun; rare with the sun high in the sky.

Complete 22° halo, ABC; not as bright or as well colored as earlier in the day; the inner edge red-brown.

Upper tangent arc of the 22° halo, DAE; brilliant near point of contact, and better colored than the halo; not distinct to the point where it curves downward.

The 46° halo, GFH; brilliant and strongly colored above the parhelic circle, but faint below and never visible quite to the horizon; both color and brightness generally exceeding those of the small halo during the height of the display.

Circumzenithal arc, JK; taken at first for the contact arc of the large halo—indeed the confusion is often made in print; at solar altitudes between 15° and 25° this arc is practically tangent to the halo and is chiefly distinguished by its brilliant coloring; on this occasion the color sensations predominating were violet, yellow-green, orange, and red; the colors were approximately saturated, and were pure in sharp contrast to the broken colors of the other arcs; generally about 60° of arc distinctly visible, but occasionally slightly more.

The parhelia or mock-suns, P and Q, of the small halo were sometimes extremely brilliant, but the presence of the horizontal circle made their colors indistinct. The extremely rare mock-suns, N and R, of the large halo were distinctly visible several times; they were never brilliant and the horizontal circle rendered both color and extent indefinite; lacking accurate means of measurement, it can only be said that they were in approximately the calculated position several degrees outside the halo. Pernter¹ estimates about seven authentic records of this phenomenon, some early descriptions evidently referring merely to the enhancement of light at the intersection of halo and horizontal circle. The counter-sun, T, was visible for a short time as a diffuse light patch, too inconspicuous to be seen by anyone not looking for it.

¹ Pernter, J. M., *Meteorologische Optik*, Dritter Abschnitt. 1902.

Pernter gives the observers' descriptions and sketches of the three great classical halo displays: The Rome display of 1630, the Danzig display of 1661, and the St. Petersburg display of 1794. The last named, in particular, included a somewhat more prolific display of arcs (some of them inaccurately recorded), but only the Rome display included, doubtfully, parhelia of the 46° halo. None of these displays included a sun pillar. Several other relatively complete displays, accounts of which I have seen, have included certain arcs or mock-suns other than those here described. (See, e. g., MONTHLY WEATHER REVIEW, 48: 330-331, 1920.) The Ottawa display appears, however, to have been one of the few with a definite sun pillar. The distinction is explained by the fact that the pillar is seldom seen when the sun is more than a few degrees above the horizon, whereas most of the other phenomena are best seen when the sun is high. The pillar, which, with the horizontal circle, formed a cross through the sun, was a striking feature of the Ottawa display.

Curiously enough, the sun pillar, although it may be seen dozens of times a year at sunrise or sunset, has never been satisfactorily explained. Minnaert² sums up such explanations as have been put forward, and challenges the reader to complete the solution.

It is clear that a pillar formed with a solar altitude of about 25° cannot possibly be explained by the supposition of reflection from ice plates oscillating only slightly from a predominantly horizontal position. My own observations suggest that a distinct pillar is usually observed, other conditions permitting, when there is a steady wind, evident either from its local effect or from cloud forms, blowing approximately at right angles to the line connecting the sun and the observer. Such a wind might cause a preponderance of long hexagonal ice prisms to lie with their axes of symmetry horizontal and in the direction of the wind. This effect could produce a distinct pillar with high solar altitudes. It may well have been the explanation in the case under discussion, for the presence of the parhelia of the large halo proves that there was at times a preponderance of crystals with their 90° refracting edges vertical. Moreover, the wind at ground level was blowing steadily from the southeast; and, since the barometer was falling steadily, the same direction probably prevailed at high altitudes.

A complication arises from the brilliance of the large halo. The fact that it was considerably brighter than the small ring during the height of the display indicates

² Minnaert, M. *Light and Colour in the Open Air*. London, 1940. Cf. MONTHLY WEATHER REVIEW, 63: 57-58, 1935.

an abundance of platelike crystals to account for refraction through the 90° faces outweighing that through the 60° faces of the randomly arranged crystals. It is doubtful whether such forms could have been predominantly oriented in the position required to give rise to either mock-suns or pillar. Possibly the explanation lies in the umbrella-shaped crystals that give rise to the mock-suns of the small halo. Such forms might lie with their principal axes horizontal in a strong wind and yet refract predominantly through their 90° faces. An alternative explanation is suggested by the occasional observation of a vague lattice structure in the cirro-nebula, which suggests that there were actually two distinct layers of cloud involved. Possibly there were different crystals forms and even different directions of movement in the two sheets.

It was hoped that some upper-air observations might be obtainable for the time of this display; but the clouds were far above the levels commonly utilized in commercial aviation, and no pertinent information was available. I have, however, to thank Mr. Jefferson, of Trans-Canada Air Lines, for his offer to make balloon observations, should future displays warrant the attempt.

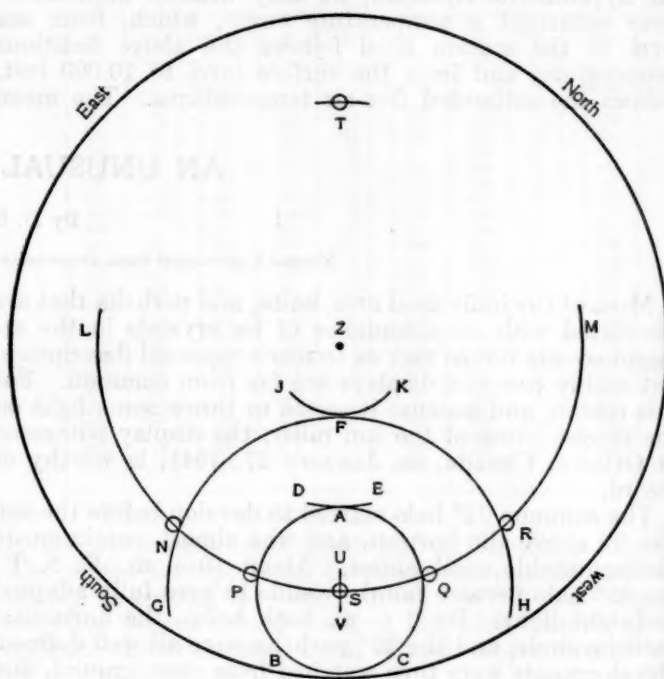


FIGURE 1.

AEROLOGICAL NORMAL DATA

Monthly tables, showing normal values of temperature and relative humidity for standard levels up to 5 kilometers, were recently printed by the Weather Bureau. These tables include all available kite, airplane, and radiosonde records for the United States as well as for St.

Thomas, V. I., Coco Solo, C. Z., and Pearl Harbor, T. H., through June 1939.

A limited supply of these tables are available for distribution and may be secured by applying to the Chief, United States Weather Bureau, Washington, D. C.

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR MARCH 1941

(Climate and Crop Weather Division, J. B. KINCE in charge)

AEROLOGICAL OBSERVATIONS

By EARL C. THOM

Mean surface temperatures for March were below normal over about two-thirds of the United States (chart I). Surface temperatures were above normal west of the Great Divide and over the extreme North Central States with the largest positive departures, slightly over 8° F., occurring along the Washington and Oregon coastal areas. Temperatures were lower than normal over the rest of the country with mean monthly surface temperatures as much as 8° below normal in a small area of the Central Atlantic States.

At the 1,500 m. level the 5 a. m. resultant winds were from directions to the north of the corresponding normals over the eastern two thirds of the country with an opposite shift at this level over most stations to the westward. At the 3,000 m. level the morning resultant winds were from directions to the north of normal over most of the country. Over the southwest and over the extreme west central areas, however, a turning to the south of normal occurred at this level. At 5,000 meters the 5 p. m. resultant winds were from directions to the north of the 5 a. m. normals at nearly all stations for which this comparison could be made.

At both the 1,500 m. and the 3,000 m. levels the 5 a. m. resultant velocities for the month were above normal over most stations in the extreme eastern part of the United States and were below normal quite generally to the westward. At 5,000 meters the 5 p. m. resultant velocities were higher than the corresponding 5 a. m. normals over most of the country; below normal velocities being noted only over the northwest and extreme west central areas.

The directions of the 5 p. m. resultant winds were to the south of the corresponding 5 a. m. winds for March at the 1,500-meter level over most of the country. A shifting of resultant winds to the northward during the day occurred, however over the extreme northeast, over the Gulf coast and over a considerable area in the middle plateau and west central states. At 3,000 meters the evening resultant winds for the month were from directions to the south of the corresponding morning normals over most stations in the western half of the country and over about half of those to the eastward. The resultant winds shifted to the northward during the day at this level over scattered stations in the northeast, the Gulf coast, the Upper Mississippi Valley and the Pacific Northwest.

At the 1,500 m. level the 5 p. m. resultant velocities were lower than the corresponding 5 a. m. velocities over most of the United States. Velocities higher in the afternoon than those in the morning were, however, recorded at this level over the extreme southeast coastal region, over the southwest and over an area in the northwest. At 3,000 m. the increases and decreases in resultant velocity over the various stations during the day were evenly divided, with no well defined areas separating such diurnal changes in resultant velocities.

It is noted that again in March the area of below normal surface temperatures corresponded closely with the area over which at 1,500 meters, the directions of the resultants were to the north of normal.

The upper air data discussed above are based on 5 a. m. (E. S. T.) pilot-balloon observations (charts VIII and IX)

as well as on the observations made at 5 p. m. (table 2 and charts X and XI).

At radiosonde and airplane stations in the United States proper the highest mean monthly pressure was recorded over Brownsville, Tex., at the 4,000-, 6,000-, and 16,000-meter levels, over Miami, Fla., at the 9,000-, 10,000-, 12,000- and 13,000-meter levels, while the corresponding maximum value was recorded over both Brownsville and Miami at all the other standard levels from 1,500 to 16,000 meters, inclusive. The lowest mean monthly pressure was recorded over Portland, Maine, at each of the standard levels from 1,500 to 6,000 meters, over Sault Ste. Marie, Mich., at each of the levels from 8,000 to 16,000 meters, inclusive, while the corresponding minimum, 395 mb., occurred over both Portland and Sault Ste. Marie at 7,000 meters.

At each of the standard levels from 1,000 to 14,000 meters, inclusive, the mean monthly pressures over all Alaskan stations north of 60°N. latitude were lower than the corresponding minimum pressures over the United States proper. At Juneau and Ketchikan the mean pressures at these levels were lower than the corresponding mean monthly pressures recorded over most stations of the United States but were higher than the minima. At all standard levels from 1,000 to 18,000 meters the mean monthly pressures over San Juan were higher than the corresponding maxima for stations in the United States.

The mean monthly pressures were higher than those of last month over most stations of the United States at each of the standard levels from the surface to 11,000 meters while the pressures were generally lower at higher levels. Pressures were, however, lower than last month at some of the levels up to 11,000 meters over a small area in the southwest and were slightly higher than last month at the higher levels over Portland, Maine, over the Great Lakes and over a small area in the middle Mississippi Valley.

In Alaska the mean monthly pressures were higher than last month at all levels over Ketchikan, and were also higher at levels above 1,000 meters over Juneau. Pressures were lower than last month at all levels over Fairbanks and over Anchorage. Over Bethel pressures were the same or higher than in February at levels up to 4,000 meters and were lower at all higher levels, while over Nome pressures were the same or higher this month at all levels up to 15,000 meters and slightly lower at higher levels.

The largest difference between the maximum and minimum mean monthly pressures at any of the standard levels for stations in the United States was 31 mb. at 8,000 meters. Steep pressure gradients appear on the mean pressure charts from north to south over the eastern third of the country, being steepest at the 6,000-, 7,000-, 8,000-, and 9,000-meter levels. At both 7,000 and 8,000 meters, for example, a change of 1 mb. was recorded for each 46 miles of horizontal distance between Buffalo, N. Y., and Washington, D. C., while a similar pressure change was noted at these two levels for a horizontal distance of 50 miles or less between Sault Ste. Marie and Nashville and between Sault Ste. Marie and Pensacola.

Mean monthly temperatures over the United States were generally higher for March than for February at levels from the surface up to and including 3,000 meters. This increase in temperature at the lower levels was especially marked over an area in the North Central States

where the mean temperature of the lowest 1,000 meters of free air averaged about 5° C. higher than last month. At the 5,000-, 6,000-, and 7,000-meter levels temperatures were higher than last month over most stations in the northern third of the country, were lower than last month over the Southwest and West Central States, while the areas of corresponding temperature changes were not well defined at these levels over the balance of the country. At levels above 8,000 meters temperatures were generally lower than last month over stations in the northern third of the country and along the Pacific coast with areas of temperature change not well defined over the remainder of the United States.

Alaskan stations north of 60° N. latitude reported mean temperatures lower than those of last month at most of the standard levels below 10,000 meters while an increase in temperature occurred at these levels over Alaskan stations south of this line. At all levels above 10,000 meters temperatures were lower than those of last month over all Alaskan stations.

Comparison of the mean temperature charts for March 1941 with those for March 1940 show that temperatures at most of the standard levels from the surface up to and including 6,000 meters were higher than those of last year over stations in the United States north of 40° N. latitude and were generally lower than last year at these levels over all stations to the southward. At higher levels the corresponding changes were well distributed, temperatures at most stations being higher than last year at some upper levels and lower at others so that areas of distinct change in temperature from those reported last year cannot be defined for the upper levels.

Only two of the Alaskan stations, Juneau and Fairbanks, were making radiosonde observations during March of last year. At both of these stations temperatures were higher than last year at all levels up to 8 kilometers and were lower than last year at the higher levels for which temperatures were reported.

With the issuance of a Climate and Crop Weather Division publication, Mean Values of Upper-Air Data, by C. L. Rock under date of April 1, 1941, there are available normal data with which the mean monthly upper-air values can be compared. The following discussion of such departures from normal is based on mean values computed by Rock comparing radiosonde data for March 1941 as taken from radiosonde observations with normals for either the same stations or with normals for nearby stations which should be representative of the free-air conditions in each particular area.

At 1,000 meters the mean temperatures were above normal at all stations north and west of a line drawn across the country through Williston and Los Angeles while the opposite departure was recorded at all other stations. Temperatures at Spokane and at Seattle were nearly 3° C. above normal at 1,000 meters while temperatures over an area in the Central Mississippi Valley averaged nearly 7° below normal. At 3,000 meters the areas of departures from normal temperature were the same as at 1,000 meters except that a positive temperature departure occurred at Bismarck, N. Dak., at the higher level. At 5,000 meters free-air temperatures were above normal over the North Central, the Northwest and the West Central sections with negative departures indicated over the remainder of the country.

At 1,000 meters relative humidities were somewhat below normal over the Northwest, the West Central, the extreme Northeast, also over Nashville and Norfolk and were above normal at this level over the rest of the country. At 3,000 meters relative humidities were below normal

over San Francisco, Great Falls, Bismarck, and Norfolk and were above normal over all other stations. At 5,000 meters the relative humidity was somewhat below normal over Bismarck, and over the southern Atlantic coast and over the Southwest and was considerably above normal over most other sections of the country.

There is but little apparent connection between the areas of above normal precipitation for the month and the areas of above normal relative humidities. It was noted, however, that the average departure of relative humidity at the 3,000-meter level for the four stations, Denver, Oklahoma City, El Paso, and San Diego was plus 11 percent and that these four cities roughly border an area in which the precipitation averaged about 225 percent above normal. This apparent relationship for this area at this level however does not hold in other sections of the country, for example, at St. Louis the relative humidity was 18 percent above normal while the precipitation for the two States of Missouri and Illinois averaged 69 percent below normal for the month.

A more consistent relation appears to be that shown by the resultant winds blowing from directions more southerly than is normal for March over the southwestern part of the country at both the 1,500- and 3,000-meter levels. It appears likely that this mass transport of air moving from over the Pacific Ocean waters which are quite warm, resulted in more than the normal amount of moisture over this area. At Phoenix, for example, the normal resultant direction for the month is 285° (WNW) at 1,500 meters and 270° (W) at 3,000 meters while the corresponding resultant directions for March this year were 255° (WSW) and 237° (SW), respectively. Assuming a considerable trajectory over the ocean it appears likely from the values shown on chart 117 of the Atlas of the Climatic Charts of the Oceans that the temperatures of the waters over which these winds moved were about 5° F. higher than the temperatures of the waters over which these winds normally move during March.

The mean surface temperature for March as recorded by radiosonde observations was 0° C. or lower over that part of the northern third of the United States which lies east of Montana. Over other parts of the country this level of freezing temperature occurred at levels varying from 700 meters (m. s. l.) over Omaha to 3,900 meters over Brownsville. Except at three stations the level at which mean freezing occurred was either the same or higher than last month.

The lowest temperature recorded in the free air over the United States was -84.0° C. (-119.2° F.) recorded on March 25 at a height of 17,400 meters (about 11 miles) above sea level over Miami, Fla. A lower temperature -86.4° C. (-123.4° F.) was, however, recorded at 17,400 meters over San Juan on March 18.

Table 3 shows the maximum free-air wind velocities and their directions for various sections of the United States during March as determined by pilot-balloon observations. The highest wind velocity reported for the month was 73.8 m. p. s. (165 m. p. h.) observed over Jacksonville, Fla., on March 12. This wind was blowing from the west-northwest at an altitude of 9,580 meters (about 6 miles) above sea level.

The highest wind velocity observed in the free-air layer below 2,500 meters during March in the last 5 years was 53.0 m. p. s. over Phoenix, Ariz., in March this year. In the free-air layer from 2,500 to 5,000 meters the highest March wind velocity during this period was 70.0 m. p. s. over Albany, N. Y., in 1938, while at levels above 5,000 meters the corresponding extreme 80.0 m. p. s. occurred over Las Vegas in 1939.

CORRECTIONS

1. The data, appearing as a late report for Juneau, Alaska in table 1 in the November 1940 issue of the MONTHLY WEATHER REVIEW were for October 1940.

2. The third paragraph of the annual summary of aerological observations which appears on page 355 of the December issue of the MONTHLY WEATHER REVIEW

should be corrected to show that pilot-balloon and radio-sonde observations were started at the two Atlantic Stations in February 1940 instead of in May as stated.

Observations taken prior to May 1940 on board the Coast Guard cutters located as Atlantic Stations No. 1 and No. 2 have not as yet, however, been summarized and published.

TABLE 1.—Mean free-air barometric pressure in millibars, temperature in degrees centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during March 1941

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																											
	Albuquerque, N. Mex. (1,620 m.)				Anchorage, Alaska (41 m.)				Atlanta, Ga. (300 m.)				Atlantic Station No. 1 ³ (3 m.)				Atlantic Station No. 2 ⁴ (3 m.)				Barrow, Alaska (6 m.)				Bethel, Alaska (7 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	17	836	6.4	65	31	998	1.1	69	31	983	5.1	73	25	1,011	11.6	73	22	1,013	15.4	81	31	1,024	-28.1	98	31	1,002	-9.2	79
500					31	943	0.0	70	31	959	5.6	69	25	952	6.7	79	22	954	11.1	81	31	957	-22.6	88	31	942	-5.6	74
1,000					31	885	-2.7	70	31	902	4.0	66	25	895	2.3	84	22	899	7.6	82	31	894	-20.6	81	31	883	-8.8	74
1,500					31	830	-6.6	73	31	848	2.8	61	25	841	-1.0	84	22	846	4.6	83	31	836	-20.0	76	31	828	-9.2	75
2,000	17	798	5.7	66	31	779	-10.2	76	31	797	0.9	58	25	790	-3.4	79	22	795	1.8	79	31	781	-21.2	71	31	776	-12.2	75
2,500	17	750	2.7	63	31	730	-13.5	77	31	748	-1.0	52	25	742	-6.0	72	22	747	-0.8	75	31	729	-22.9	65	31	726	-15.2	74
3,000	17	704	-1.1	64	31	683	-16.8	77	31	702	-3.5	49	25	695	-8.3	67	22	701	-3.3	70	31	681	-25.1	63	31	679	-18.3	72
4,000	17	621	-8.0	67	29	597	-22.8	75	30	619	-9.2	45	24	610	-14.4	58	22	617	-8.5	58	31	592	-30.4	61	30	593	-24.7	68
5,000	17	545	-15.2	64	28	520	-29.8	74	30	543	-15.2	46	24	534	-20.7	56	22	542	-15.1	52	31	514	-36.5	59	30	516	-31.2	65
6,000	17	476	-22.5	56	28	451	-37.2	72	30	475	-22.1	44	23	466	-27.5	53	22	474	-21.8	50	30	445	-42.3	50	30	448	-37.1	61
7,000	17	415	-30.2	53	26	390	-43.6	69	27	414	-29.0	41	23	404	-34.1	51	21	413	-28.7	49	30	383	-47.4	45	30	387	-43.8	61
8,000	17	360	-38.4	50	26	335	-49.6	66	27	359	-35.8	39	23	350	-40.8	45	20	358	-35.3	45	29	328	-50.8	40	30	332	-49.7	61
9,000	17	310	-44.9	46	26	287	-52.9	62	27	310	-42.1	35	23	301	-46.6	40	18	310	-43.5	45	27	282	-51.3	35	30	285	-52.5	61
10,000	17	266	-51.3	42	26	246	-53.3	58	26	267	-48.9	30	23	259	-52.0	35	17	266	-50.9	40	27	242	-50.5	30	29	244	-52.1	61
11,000	17	228	-56.1	38	25	211	-61.6	54	24	229	-54.8	25	22	222	-55.3	30	16	228	-56.9	35	25	207	-48.7	25	29	210	-50.3	61
12,000	17	195	-57.3	34	25	181	-60.6	50	24	196	-58.4	20	19	190	-66.5	25	14	194	-69.1	30	23	178	-48.1	23	27	180	-49.0	61
13,000	17	166	-56.8	30	24	155	-49.9	46	22	167	-58.7	18	19	162	-55.8	20	11	166	-58.5	25	23	153	-48.1	21	25	154	-49.0	61
14,000	16	142	-58.6	26	24	133	-49.8	42	20	142	-59.4	18	18	138	-55.8	18	9	141	-57.5	20	20	131	-48.2	24	24	132	-49.2	61
15,000	16	121	-60.0	23	23	114	-50.2	38	18	120	-61.7	16	18	118	-66.5	16	8	120	-69.2	19	19	113	-48.7	21	21	114	-49.8	61
16,000	15	104	-61.6	21	21	98	-60.8	34	15	102	-63.6	16	16	101	-66.9	14	7	102	-60.5	12	12	96	-49.6	15	17	97	-50.8	61
17,000	14	88	-61.7	13	13	84	-61.7	30	10	87	-62.3	14	14	86	-67.4	12	7	87	-61.1	6	6	82	-50.5	11	11	84	-51.9	61
18,000	10	75	-60.3	11	11	72	-62.8	26	8	73	-62.1	13	13	73	-67.6	10	6	74	-60.0	6	6	68	-49.6	6	6	71	-62.7	61
19,000	6	64	-60.6	7	6	61	-64.1	22				10	62	-67.7														

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																											
	Bismarck, N. Dak. (505 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Charleston, S. C. (14 m.)				Coco Solo, C. Z. ¹³ (1 m.)				Denver, Colo. (1,616 m.)				El Paso, Tex. (1,193 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	30	960	-4.5	83	31	1,016	15.1	90	31	990	-4.6	83	31	1,016	7.9	77	23	1,013	26.7	82	31	837	0.7	75	30	881	10.1	52
500					31	959	14.1	86	31	956	-5.1	83	31	958	8.0	63	23	958	23.6	91	31				30	849	10.1	49
1,000	30	902	-4.8	75	31	904	12.4	81	31	896	-7.6	78	31	901	5.2	62	23	904	20.5	79	31				30	799	7.5	48
1,500	30	846	-5.4	72	31	852	11.4	71	31	840	-9.4	76	31	847	2.9	62	23	853	17.3	78	31				30	752	4.2	48
2,000	30	793	-5.9	63	31	802	10.0	60	31	787	-10.6	72	31	796	1.0	60	23	804	14.9	71	30	798	0.0	73	30	732	4.2	47
2,500	30	745	-7.6	57	31	755	8.2	51	30	738	-12.5	68	31	748	-1.0	55	21	758	13.9	45	30	749	-2.4	70	30	707	6	47
3,000	30	698	-10.4	57	31	710	5.5	48	30	691	-14.6	63	31	702	-3.5	51	21	714	11.9	29	31	703	-5.5	67	30	707	6	47
4,000	29	612	-16.6	56	31	628	-1.5	44	30	604	-19.6	58	31	618	-8.6	46	14	633	6.0	19	31	618	-12.0	66	30	623	-6.7	48
5,000	29	535	-22.9	54	31	553	-7.4	41	30	528	-25.6	56	31	543	-15.2	44					31	542	-18.8	63	30	548	-13.6	42
6,000	29	466	-29.9	52	31	489	-14.5	39	30	459	-32.3	54	31	475	-21.9	43					31	473	-26.0	60	30	480	-30.9	38
7,000	29	404	-37.1	50	31	425	-21.3	38	29	397	-39.4	52	31	414	-28.9	42					31	411	-23.6	58	30	418	-27.9	37
8,000	29	349	-44.4	46	30	371	-27.6	37	29	342	-45.8	48	31	359	-36.1	43					31	355	-41.8	50	30	363	-35.1	35
9,000	29	300	-51.4	42	28	321	-34.2	36	28	294	-51.3	44	31	310	-43.1	40					31	306	-48.8	48	30	314	-42.3	35
10,000	29	257	-57.1	38	27	278	-40.9	34	28	252	-54.0	40	31	266	-49.6	36					30	262	-54.8	50	30	270	-48.6	35
11,000	28	219	-58.9	34	27	240	-47.4	30	28	216	-53.8	38	31	228	-54.9	32					30	224	-58.3	53	30	232	-53.3	35
12,000	28	187	-56.8	30	26	205	-53.6	26	25	184	-52.7	34	31	195	-57.0	28					30	191	-58.2	50	30	198	-56.3	35
13,000	27	160	-55.0	26	26	175	-58.7	22	25	158	-52.4	30	30	167	-57.7	26					30	163	-56.5	50	30	169	-58.1	35
14,000	27	137	-55.0	25	25	149	-62.9	19	23	135	-62.7	28	29	142	-59.4	24					30	139	-56.1	50	30	144	-60.6	35
15,000	23	117	-55.4	23	23	126	-66.8	17	21	116	-63.3	26	27	121	-61.6	22					30	119	-67.0	50	30	123	-62.3	35
16,000	20	100	-56.7	19	19	107	-70.5	14	18	98	-64.3	26	26	103	-63.9	20					26	102	-68.0	50	30	105	-64.3	35
17,000	11	86	-57.4	15	15	91	-71.7	11	14	84	-65.0	21	21	87	-63.1	18					23	87	-68.9	50	29	88	-65.5	35
18,000	7	73	-57.7	13	13	76	-71.0	11	11	72	-64.7	13	13	74	-62.7	16					16	74	-69.6	50	26	75	-64.6	35
19,000				9	9	64	-67.8					10	63	-61.6							11	63	-59.8	50	14	63	-62.7	35

See footnotes at end of table.

TABLE 1.—Mean free-air barometric pressure in millibars, temperature in degrees centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during March 1941—Continued

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																											
	Ely, Nev. (1908 m.)			Fairbanks, Alaska (153 m.)			Great Falls, Mont. (1,117 m.)			Joliet, Ill. (178 m.)			Juneau, Alaska (49 m.)			Ketchikan, Alaska (26 m.)			Lakehurst, N. J. (39 m.)									
	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity				
Surface	31	807	0.8	72	30	990	-6.9	59	31	888	0.7	66	30	998	-1.9	85	30	1,006	3.9	82	30	1,011	5.3	81	30	1,009	-1.7	76
500					30	947	-7.9	60					30	959	-2.6	83	30	952	1.6	83	30	953	3.8	79	30	953	-2.7	69
1,000					30	888	-8.7	62					30	900	-4.8	75	30	894	-1.5	86	30	896	0.7	77	30	895	-4.8	67
1,500					30	832	-9.7	65	31	848	0.7	63	30	844	-6.0	67	29	839	-4.5	85	29	842	-2.3	75	30	839	-6.4	63
2,000	31	798	1.6	70	30	780	-10.9	67	31	796	-1.4	60	30	792	-7.5	63	27	788	-7.5	86	28	790	-4.7	70	30	787	-8.3	60
2,500	31	750	0.1	66	30	731	-13.8	68	31	747	-4.6	60	30	742	-9.1	59	25	738	-10.4	82	28	741	-7.1	64	30	737	-10.1	58
3,000	31	704	-3.8	66	30	684	-17.4	68	30	701	-8.1	61	30	696	-11.2	59	24	692	-13.7	80	28	695	-9.5	59	30	691	-12.2	55
4,000	31	620	-10.4	59	30	597	-23.6	66	30	616	-14.7	61	30	610	-16.6	61	21	606	-19.4	77	28	610	-15.4	58	30	605	-17.6	54
5,000	31	544	-16.6	53	28	520	-29.9	64	30	539	-21.1	57	29	533	-22.6	58	16	530	-25.2	72	26	534	-21.4	56	29	529	-23.7	52
6,000	31	475	-24.3	50	28	451	-36.8	62	30	470	-28.1	54	29	464	-29.1	54	14	461	-31.2	72	24	465	-28.3	54	29	461	-30.2	53
7,000	31	413	-32.1	49	28	390	-43.6	52	30	408	-35.3	52	28	402	-36.2	51	12	400	-37.6	70	20	403	-35.8	52	29	399	-36.9	56
8,000	31	358	-40.1	47	27	336	-49.6	50	29	352	-42.5	50	28	348	-43.4	49	11	346	-44.6	68	18	349	-43.0	50	29	345	-43.8	50
9,000	30	308	-47.6	46	26	287	-53.5	49	29	303	-49.3	49	28	299	-49.8	48	9	296	-51.5	67	17	300	-50.1	49	29	297	-50.1	49
10,000	30	264	-53.8	45	26	246	-54.3	48	29	260	-55.4	48	27	256	-54.2	47	6	254	-56.3	65	15	256	-56.0	48	29	255	-54.1	48
11,000	29	226	-57.5	44	26	211	-52.1	47	29	222	-58.0	47	27	220	-55.6	46	6	217	-57.6	63	15	220	-58.9	47	29	219	-55.9	47
12,000	29	193	-58.1	43	25	180	-50.4	46	29	190	-57.2	46	25	187	-54.7	45	6	185	-55.3	61	12	187	-57.3	46	28	187	-54.9	46
13,000	29	165	-56.7	42	24	154	-50.2	45	29	162	-55.2	45	24	160	-53.3	44	6	156	-52.1	60	11	160	-55.2	47	27	160	-54.0	46
14,000	29	141	-56.6	41	23	132	-49.5	44	29	138	-54.9	44	23	137	-53.7	43	6	135	-53.1	57	10	136	-54.7	47	26	137	-55.0	45
15,000	28	120	-57.7	40	21	114	-49.7	43	28	118	-55.2	43	21	117	-54.0	42	7	117	-55.0	54	7	117	-55.0	48	19	117	-56.4	44
16,000	27	103	-58.8	39	16	97	-49.8	42	27	101	-55.9	42	17	100	-54.7	41	6	100	-55.8	51	6	100	-55.8	49	14	100	-57.3	43
17,000	24	87	-59.4	38	12	84	-50.5	41	25	87	-56.6	41	11	85	-54.9	40	5	86	-55.6	49	5	86	-55.6	47	8	84	-58.8	42
18,000	17	74	-60.0	37	6	72	-51.4	40	19	74	-57.4	40	6	72	-56.0	39	5	74	-57.4	49	5	74	-57.4	47	5	74	-57.4	42

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																											
	Medford, Oreg. (401 m.)			Miami, Fla. (4 m.)			Nashville, Tenn. (180 m.)			Nome, Alaska (14 m.)			Norfolk, Va. ¹ (10 m.)			Oakland, Calif. (2 m)			Oklahoma City, Okla. (391 m.)									
	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity				
Surface	30	967	9.1	67	31	1,017	15.6	86	31	998	4.3	68	31	1,008	-10.9	70	23	1,019	3.0	63	31	1,014	12.3	80	30	973	5.4	71
500	30	956	10.4	66	31	959	15.0	78	31	959	3.8	67	31	946	-11.7	72	23	959	3.0	52	31	956	10.8	73	30	959	6.1	70
1,000	30	900	9.5	61	31	904	11.7	79	31	902	1.2	66	31	886	-11.9	74	23	901	0.6	48	31	900	8.4	67	30	903	4.8	64
1,500	30	847	5.8	62	31	852	9.6	68	31	847	-0.7	65	31	830	-13.1	73	23	846	-1.9	46	31	847	5.9	61	30	849	3.3	61
2,000	30	796	2.3	64	31	802	8.0	56	31	795	-2.1	61	31	777	-15.2	72	23	795	-3.8	45	31	797	3.0	57	30	798	1.7	59
2,500	30	748	-0.5	62	31	755	6.5	46	31	747	-4.0	60	31	727	-18.1	72	23	746	-5.7	42	31	749	0.2	52	30	750	-0.6	58
3,000	30	703	-3.1	58	31	710	4.1	44	31	701	-6.0	58	31	680	-20.8	70	23	699	-7.9	42	31	703	-2.6	49	30	704	-3.1	56
4,000	30	618	-9.6	55	31	627	-1.3	40	31	616	-11.9	56	31	593	-26.7	67	22	613	-12.8	40	31	619	-8.7	46	29	620	-9.2	56
5,000	30	543	-16.5	51	31	553	-7.3	36	30	540	-18.3	53	31	515	-32.9	66	21	538	-18.2	37	31	543	-15.7	42	29	544	-15.8	51
6,000	30	474	-24.0	49	29	485	-13.5	34	30	471	-25.2	51	31	446	-39.4	62	21	475	-23.0	41	29	475	-22.9	45	29	475	-22.9	45
7,000	30	412	-31.7	48	28	425	-20.0	34	30	410	-31.7	49	31	385	-45.4	49	31	414	-30.9	41	28	414	-30.9	41	28	414	-30.5	41
8,000	30	357	-39.7	47	28	371	-26.4	34	30	355	-39.0	49	31	331	-50.3	49	31	359	-38.7	41	28	358	-38.0	41	28	358	-38.0	41
9,000	30	308	-47.5	46	28	322	-33.3	34	30	306	-45.7	47	30	283	-52.9	47	30	309	-46.0	40	26	309	-45.4	40	26	309	-45.4	40
10,000	30	264	-54.8	45	27	279	-41.1	33	30	263	-51.7	46	29	243	-52.5	46	30	266	-52.8	39	25	266	-51.6	39	25	266	-51.6	39
11,000	30	226	-59.3	44	27	240	-48.4	32	29	226	-55.8	45	28	208	-51.0	45	28	227	-57.7	37	25	228	-56.1	37	25	228	-56.1	37
12,000	30	192	-60.1	43	27	206	-54.8	31	29	193	-57.0	44	27	178	-49.7	44	28	194	-58.5	35	24	194	-57.8	35	24	194	-57.8	35
13,000	30	164	-57.5	42	27	176	-60.8	30	28	164	-56.4	43	27	153	-49.5	43	28	165	-57.5	33	23	166	-57.5	33	23	166	-57.5	33
14,000	29	140	-56.6	41	26	149	-65.6	29	27	141	-56.8	42	24	131	-49.9	42	26	141	-57.1	30	20	141	-58.3	30	20	141	-58.3	30
15,000	28	119	-57.1	40	26	126	-70.0	28	25	120	-58.1	41	22	113	-50.3	41	24	120	-58.1	27	19	120	-58.9	27	19	120	-58.9	27
16,000	24	102	-58.5	39	24	106	-73.0	27	22	102	-59.6	40	16	96	-50.9	40	22	102	-59.6	24	17	102	-60.6	24	17	102	-60.6	24
17,000	21	87	-59.2	38	19	90	-74.0	26	22	87	-60.5	41	10	83	-51.6	41	18	87	-60.7	21	15	87	-60.6	21	15	87	-60.6	21
18,000	18	74	-59.1	37	13	76	-70.7	25	18	75	-60.4	42	10	74	-51.6	42	14	74	-60.4	12	12	74	-60.1	12	12	74	-60.1	12
19,000	14	63	-59.0	36	7	65	-66.6	24	11	63	-60.5	43	10	63	-51.6	43	5	63	-60.6	11	6	63	-59.0	11	6	63	-59.0	11
20,000	14	63	-59.0	35	5	55	-65.5	23	11	63	-60.5	44	10	63	-51.6	44												

TABLE 1.—Mean free-air barometric pressure in millibars, temperature in degrees centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during March 1941—Continued

Altitude (meters), m. s. l.	Stations with elevations in meters above sea level																											
	Omaha, Nebr. (301 m.)			Pearl Harbor, T. H. (6 m.) ^{1,2}			Pensacola, Fla. ^{1,3} (24 m.)			Phoenix, Ariz. (339 m.)			Portland, Maine (9 m.)			Saint Louis, Mo. (171 m.)			Saint Paul, Minn. (214 m.)									
	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity				
Surface	31	984	0.7	78	30	1,018	20.2	77	31	1,017	12.3	75	31	974	12.0	79	31	1,008	-4.4	77	31	999	2.7	67	31	992	-3.0	80
500	31	960	0.4	74	30	962	18.0	79	31	961	10.7	67	31	956	15.4	61	31	948	-3.9	70	31	959	1.6	68	31	959	-3.4	80
1,000	31	902	-1.7	72	30	907	14.9	84	31	904	8.6	63	31	890	-6.4	68	31	901	-0.9	68	31	901	-0.9	68	31	900	-4.9	70
1,500	31	847	-2.2	66	30	856	12.3	82	31	851	6.9	58	31	848	-8.7	50	31	834	-8.4	67	31	846	-2.8	65	31	844	-6.0	75
2,000	31	795	-3.6	65	30	806	11.5	57	31	801	5.1	53	31	798	-5.9	51	31	782	-9.6	66	31	794	-4.0	63	31	792	-7.1	69
2,500	31	746	-5.7	62	30	759	10.6	35	31	753	2.6	50	31	751	-2.3	53	31	733	-11.4	65	31	745	-5.9	62	31	743	-8.9	65
3,000	31	700	-8.3	60	30	715	9.0	23	31	708	0.1	48	31	705	-1.2	54	31	686	-14.1	64	31	699	-8.3	61	31	696	-10.8	61
4,000	31	614	-13.9	57	30	633	4.3	11	31	624	-5.5	51	31	622	-7.3	45	31	601	-19.5	62	31	614	-14.3	59	31	610	-16.9	58
5,000	31	538	-20.5	53	30	548	-11.9	56	31	546	-14.4	41	30	524	-25.0	57	30	537	-20.8	56	30	533	-23.1	57	30	533	-23.1	57
6,000	30	469	-27.1	51	25	480	-18.7	56	30	478	-21.7	38	30	456	-31.6	56	30	468	-27.6	53	30	464	-30.0	53	30	464	-30.0	53
7,000	29	407	-34.7	50	24	419	-26.0	56	30	416	-29.3	38	30	395	-38.6	57	30	406	-34.5	50	30	403	-37.2	54	30	403	-37.2	54
8,000	29	352	-42.1	—	21	364	-33.0	59	30	361	-37.0	37	30	341	-45.1	—	29	352	-41.9	—	30	348	-44.4	—	30	348	-44.4	—
9,000	28	303	-49.1	—	19	315	-39.8	—	30	312	-44.1	—	29	293	-50.0	—	28	302	-49.1	—	30	298	-51.3	—	30	298	-51.3	—
10,000	28	259	-54.6	—	17	272	-46.4	—	30	268	-50.2	—	27	251	-51.2	—	26	259	-54.7	—	30	255	-56.0	—	30	255	-56.0	—
11,000	28	222	-57.0	—	15	234	-53.0	—	29	230	-54.6	—	26	216	-50.2	—	24	222	-58.1	—	30	219	-57.4	—	30	219	-57.4	—
12,000	28	189	-57.2	—	10	200	-58.1	—	29	197	-56.7	—	26	185	-50.0	—	24	189	-58.6	—	30	186	-54.9	—	30	186	-54.9	—
13,000	28	162	-55.3	—	7	170	-61.3	—	28	168	-56.9	—	21	159	-50.6	—	23	162	-57.1	—	30	159	-53.8	—	30	159	-53.8	—
14,000	28	138	-54.9	—	—	—	—	—	27	143	-58.3	—	19	136	-51.8	—	21	138	-57.0	—	30	136	-54.0	—	30	136	-54.0	—
15,000	24	118	-55.5	—	—	—	—	—	25	122	-60.3	—	14	117	-52.9	—	18	118	-57.5	—	29	116	-54.7	—	29	116	-54.7	—
16,000	19	101	-56.2	—	—	—	—	—	24	104	-62.7	—	10	100	-54.1	—	17	100	-58.2	—	28	100	-58.6	—	28	100	-58.6	—
17,000	11	86	-56.6	—	—	—	—	—	24	88	-63.9	—	5	85	-55.9	—	15	85	-58.7	—	23	85	-56.3	—	23	85	-56.3	—
18,000	—	—	—	—	—	—	—	—	19	75	-63.2	—	—	—	—	—	12	73	-58.6	—	17	72	-56.9	—	17	72	-56.9	—
19,000	—	—	—	—	—	—	—	—	13	64	-62.0	—	—	—	—	—	—	—	—	—	7	62	-56.9	—	—	—	—	—

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																										
	St. Thomas VI ^{1,2} (8 m.)			San Diego, Calif. ^{1,3} (19 m.)			San Juan, P. R. (15 m.)			Sault Ste. Marie, Mich. (221 m.)			Seattle, Wash. ¹ (27 m.)			Spokane, Wash. (598 m.)											
	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity	Number of ob- servations	Pressure	Temperature	Relative hu- midity							
Surface	30	1,017	25.9	74	27	1,012	15.9	80	31	1,014	23.3	85	31	991	-6.7	78	31	1,013	9.9	76	31	946	4.2	79			
500	30	961	22.4	80	27	955	13.3	70	31	959	21.8	83	31	956	-7.4	79	31	956	9.1	64	31	901	5.2	68			
1,000	30	908	19.3	86	27	901	10.7	66	31	906	18.4	83	31	897	-9.3	77	31	901	6.0	62	31	847	1.9	69			
1,500	30	856	16.2	82	27	848	8.0	60	31	854	15.5	80	31	840	-11.1	73	31	847	2.6	63	31	796	-1.6	60			
2,000	30	807	13.8	79	27	798	5.1	55	31	805	13.8	68	31	787	-12.7	70	31	796	-0.7	64	31	747	-4.8	62			
2,500	30	761	13.4	59	27	750	1.9	53	31	759	13.0	45	31	737	-14.4	69	31	747	-3.5	65	31	700	-7.9	61			
3,000	30	717	12.4	39	27	705	-0.7	47	30	715	11.1	36	31	690	-16.5	68	31	701	-6.8	65	31	615	-13.9	58			
4,000	30	636	8.7	16	25	621	-6.8	38	30	634	6.3	26	31	603	-21.6	66	31	616	-12.6	61	31	539	-20.5	56			
5,000	—	—	—	—	24	546	-13.6	32	29	560	0.7	23	31	526	-27.8	64	31	539	-19.3	62	31	471	-35.2	53			
6,000	—	—	—	—	24	478	-21.0	33	28	494	-5.6	22	31	457	-34.4	61	31	471	-26.6	63	31	400	-47.5	—			
7,000	—	—	—	—	22	416	-28.3	29	28	434	-12.4	22	31	395	-41.1	—	31	409	-34.0	65	30	352	-42.9	—			
8,000	—	—	—	—	22	362	-35.7	—	28	380	-19.9	21	31	340	-47.5	—	31	354	-41.7	—	30	303	-50.1	—			
9,000	—	—	—	—	22	312	-43.1	—	28	331	-27.5	21	31	292	-52.6	—	31	304	-49.5	—	29	259	-56.9	—			
10,000	—	—	—	—	22	269	-49.8	—	28	288	-35.4	21	31	250	-54.8	—	31	261	-50.4	—	29	222	-60.2	—			
11,000	—	—	—	—	20	230	-54.2	—	28	248	-43.4	—	31	214	-53.8	—	31	225	-60.4	—	29	199	-59.6	—			
12,000	—	—	—	—	20	196	-57.3	—	28	214	-51.0	—	31	183	-52.9	—	30	190	-60.5	—	29	161	-56.8	—			
13,000	—	—	—	—	17	168	-57.9	—	27	183	-58.8	—	31	157	-52.5	—	30	162	-57.9	—	27	137	-56.3	—			
14,000	—	—	—	—	14	144	-59.1	—	27	155	-66.5	—	28	134	-52.8	—	30	139	-56.9	—	27	117	-56.7	—			
15,000	—	—	—	—	11	122	-61.0	—	24	131	-73.5	—	25	115	-53.4	—	27	115	-56.8	—	26	100	-57.2	—			
16,000	—	—	—	—	9	104	-62.7	—	23	110	-78.9	—	25	98	-54.0	—	24	101	-57.4	—	25	86	-57.6	—			
17,000	—	—	—	—	—	—	—	—	23	93	-80.4	—	18	84	-54.9	—	20	85	-58.1	—	20	73	-58.1	—			
18,000	—	—	—	—	—	—	—	—	20	77	-76.7	—	9	72	-55.4	—	10	72	-58.6	—	9	62	-58.9	—			
19,000	—	—	—	—	—	—	—	—	15	65	-70.6	—	—	—	—	—	6	60	-58.8	—	—	—	—	—	—	—	—
20,000	—	—	—	—	—	—	—	—	9	54	-65.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

See footnotes at end of table.

WEATHER ON THE NORTH ATLANTIC OCEAN

By H. C. HUNTER

Atmospheric pressure.—March 1941, was the third successive month with pressure usually averaging lower than normal over such North Atlantic waters as are covered by reports received here. The deficiency was marked over the ocean areas near Newfoundland, Nova Scotia, and New England; the readings received from Halifax are computed to show an average pressure 6.9 millibars (0.20 inch) less than that station's normal for March.

Near the Azores the pressure deficiency was considerably smaller. On the coast of Portugal the average pressure was very close to normal, while some northern Gulf of Mexico and northern West Indies stations computed slightly above normal.

The pressure extremes in available vessel reports were 1,031.5 and 984.1 millibars (30.46 and 29.06 inches). The high mark was noted near 35° N., 46° W., at a late hour of the 9th, by the American liner *Siboney*; while the low was recorded about 200 miles to eastward of Hatteras, soon after noon of the 28th, on the American liner *Borinquen*.

TABLE 1.—Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, March 1941

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	Millibars	Millibars		Millibars	
Lisbon, Portugal.....	1,016.0	+0.1	1,027	1	999	12
Horta, Azores.....	1,020.4	-1.6	1,029	7	1,002	9
Belle Isle, Newfoundland.....	1,005.1	-5.1	1,028	9	976	31
Halifax, Nova Scotia.....	1,007.7	-6.9	1,027	8	992	19
Nantucket.....	1,010.5	-4.7	1,030	7	992	9
Hatteras.....	1,015.9	-1.4	1,028	6	996	8
Turks Island.....	1,016.7	+0.1	1,022	3	1,010	28
Key West.....	1,016.6	-1.0	1,026	2	1,008	26
New Orleans.....	1,017.6	+0.3	1,030	18	1,005	6

NOTE.—All data based on available observations, departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—Those portions of the North Atlantic from which plenty of reports have come seem to have been somewhat less affected by vigorous storms than during an average March. No advices indicating hurricane winds (force 12) have come to hand, but several vessels met force 11, only one of these encounters, however, being after the 18th. The least disturbed periods were apparently the 10th to 12th and the 21st to 23d.

At the beginning of March a low of considerable energy was centered to southeastward of Nantucket, whence it moved toward the east-northeast, causing high winds over a large ocean area, though there was apparently some decrease of strength within the next day or two.

Soon afterward a vigorous storm of rapid motion came eastward from the Lake region, where it was located on the morning of the 3d, to the New England coast, then turned more toward the northeast till beyond the field of observation. The American steamship *West Kyska* and the cutter *Cayuga* reported force 11 winds as connected with this storm.

A low of moderate strength a few days afterward traveled nearly along the coast line to northeastward from a position over South Carolina early on the 8th to a location not far from Nantucket on the morning of the 9th, whence it continued northeastward. This low appears to have been the cause of the winds and waves which led to the foundering off Hatteras, probably during the night of the 7-8th, of the American schooner *George E. Klinck*, lumber laden. The crew was rescued.

On the 13th a strong low was central over the Carolinas, whence it took an unusual course toward the east-southeast for about 500 miles, then slowly turned more toward the northeast with increase in energy. Beyond the forty-fifth meridian this low was lost to observation, after three vessels, the American liner *Excambion* and the Coast Guard cutters *Bibb* and *Spencer*, had experienced winds estimated of force 11.

The steamship *Mahukona*, recently transferred to the Brazilian flag as the *Santa Clara*, while bound from Newport News to Rio de Janeiro, when between Bermuda and the northern Bahamas, in about 30°48' N., 68°42' W., radioed a distress call, probably early on the 15th. The vessels which responded found a little wreckage but no sign of any survivor. This ship may have been lost as a result of the strong weather in the low just mentioned, and another result of the low was a duststorm reported in a later paragraph, at a position far to the south-southeastward of the scene of the *Santa Clara* disaster.

The final important storm of the month was centered near the Carolina coast during the latter part of the 27th, and advanced till near Newfoundland on the morning of the 31st. This storm was notable for considerable wind force, and brought the lowest vessel-barometer reading of the month, as already mentioned.

Duststorm near the West Indies.—From the United States Army transport *John R. R. Hannay*, C. W. Lorin, master; second officer S. Elliot, observer; the following account of a duststorm met at sea has been received:

On March 15, 10 a. m., G. C. T. (about 5.30 a. m. ship's time), in latitude 21°42' N., longitude 66°45' W., experienced a duststorm which left a black, gritty, residue on the vessel. The dust appeared in patches much the same as rain squalls, this condition lasting for about 1 hour. Wind northwest, force 5.

Fog.—The reports at hand imply that there was about as much fog during March over the portions of the North Atlantic which are well covered by reports as there had been during the preceding February. A little was noted over the northern Gulf of Mexico, and some was encountered near the eastern coast of the United States from North Carolina to Maine. March usually brings more fog to these regions than was reported during this month.

Near midocean some fog was observed on the 29th and 30th within the square 35° to 40° N., 45° to 50° W. Over the main North Atlantic the fortnight from 10th to 23d yielded no report whatever of fog, but within the north-central portion of the Gulf of Mexico some was observed during the 16th and 17th.

The leading 5° square for foggiest was that from 35° to 40° N., 70° to 75° W., with a count of 4 days. The normal March occurrence there is 8 days.

OCEAN GALES AND STORMS, MARCH 1941

Vessel	Voyage		Position at time of lowest barometer		Gale began, Mar.	Time of lowest barometer, March	Gale ended, Mar.	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN													
Flomar, Am. S. S.	Cristobal	New York	30 35 N.	74 00 W.	1 28	2a, 1	2	1,005.1	WNW	WNW, 10	NW	WNW, 10	
Delisle, Am. S. S.	New York	San Juan	38 40 N.	73 10 W.	1 28	4a, 1	1	989.8	NE	NNW, 10	N	N, 11	NNW-N.
Steel Worker, Am. S. S.	Cristobal	Boston	35 01 N.	75 20 W.	1 27	8a, 1	2	1,008.1	NW	NW, 8	NNW	NW, 8	
Major Wheeler, Am. S. S.	San Juan	New York	28 06 N.	70 00 W.	1	1p, 1	2	1,006.8	W	NW, 7	NNW	NW, 8	W-NW.
Nightingale, Am. S. S.	Cristobal	do	28 24 N.	74 42 W.	1	1p, 1	2	1,009.8	NW	NW, 8	NNW	NW, 9	
Michigan, Am. S. S.	do	do	27 50 N.	74 14 W.	1	1p, 1	2	1,010.2	NW	WNW, 10	NNW	WNW, 10	W-WNW.
Santa Paula, Am. S. S.	New York	Bermuda	34 42 N.	67 48 W.	1	2a, 2	2	990.5	N	SW, 8	W	SW, 8	W-SW-W.
Exeter, Am. S. S.	Bermuda	New York	34 00 N.	66 12 W.	2	4a, 2	2	990.5	WSW	SW, 9	NW	NW, 9	SW-WNW.
West Kyska, Am. S. S.	Cristobal	do	32 45 N.	75 00 W.	4	8p, 4	4	1,009.1	WNW	WNW, 11	WNW	WNW, 11	WSW-WNW.
Cayuga, U. S. C. G.	On Station No. 1	do	38 48 N.	60 06 W.	4	8a, 5	5	1,000.7	SW	SSW, 11	WNW	SSW, 11	SW-SSW-W.
Esso Aruba, Am. S. S.	New York	Caripito	33 29 N.	70 46 W.	8	12p, 8	8	997.6	S	S, 6	S	S, 9	S-SW.
Zarembo, Am. S. S.	Takoradi	Philadelphia	36 54 N.	70 54 W.	8	2a, 9	9	995.9	SSE	SW, 8	WNW	S, 9	S-WNW.
Esso Bayway, Am. S. S.	Boston	Baytown, Tex.	34 18 N.	73 00 W.	8	4a, 9	9	997.6	S	W, 6	W	S, 9	S-W.
Mormacswan, Am. S. S.	Trinidad	Boston	35 50 N.	67 38 W.	9	6p, 9	10	993.9	S	WSW, 7	W	S, 9	SW-W.
Duane, U. S. C. G.	On Station No. 1	do	38 18 N.	59 15 W.	8	9p, 9	10	1,003.1	SSW	SSW, 8	W	S, 9	None.
Excambion, Am. S. S.	Lisbon	Bermuda	37 30 N.	27 30 W.	9	10p, 9	10	996.3	NW	NW, 8	NNE	NNE, 8	WNW-NNW.
Broad Arrow, Am. S. S.	Cartagena	Paulsboro	27 24 N.	74 30 W.	14	2p, 14	14	1,007.8	W	WNW, 8	NNW	NNW, 8	WNW-NNW.
Governor John Lind, Am. S. S.	Ponce	Boston	29 00 N.	68 15 W.	14	12p, 14	15	997.6	SW	NW, 8	NNW	NNW, 8	W-NNW.
Excambion, Am. S. S.	At Bermuda	do	32 18 N.	64 46 W.	14	5a, 15	15	990.2	E	N, 10	N	N, 11	E-N.
Alcoa Guard, Am. S. S.	St. Thomas	Bermuda	28 25 N.	64 07 W.	14	8a, 15	16	990.5	SW	W, 9	NW	W, 9	
Bibb, U. S. C. G.	Station No. 2	Norfolk	34 12 N.	63 18 W.	15	2p, 15	15	998.6	E	NNE, 9	N	NE, 11	ENE-N.
Spencer, U. S. C. G.	do	do	39 00 N.	45 30 W.	16	4a, 17	18	987.5	SE	S, 7	W	E, 11	SE-SW.
Governor John Lind, Am. S. S.	Ponce	Boston	35 42 N.	69 18 W.	17	3p, 17	20	1,004.1	WSW	W, 6	WNW	WNW, 9	WSW-WNW.
Spencer, U. S. C. G.	On Station No. 2	do	38 18 N.	46 18 W.	19	8a, 19	19	1,008.1	SSW	SSW, 9	SW	SSW, 9	None.
Hamilton, U. S. C. G.	On Station No. 1	do	38 54 N.	56 48 W.	19	1p, 19	20	999.3	WNW	W, 8	W	W, 10	WNW-W.
Duane, U. S. C. G.	Station No. 1	Boston	40 00 N.	64 00 W.	19	2p, 19	20	998.0	W	W, 8	W	WNW, 9	W-WNW.
Exeter, Am. S. S.	Lisbon	Bermuda	36 06 N.	32 06 W.	24	4p, 24	24	1,011.2	SSW	SSW, 8	SSW	SSW, 8	SSW-W.
Cathlamet, Am. S. S.	Freetown	New York	37 06 N.	71 18 W.	25	1p, 25	25	1,001.7	NW	NNW, 7	NW	NW, 9	S-NNW-NNW.
Spencer, U. S. C. G.	On Station No. 2	do	38 24 N.	45 48 W.	26	3a, 27	27	1,003.1	SE	SW, 7	SW	SE, 9	SW-W.
A Vessel	New York	Curacao	34 30 N.	72 24 W.	28	7a, 28	28	993.0	WSW	WSW, 6	W	WSW, 9	SE-WSW.
Gulferest, Am. M. S.	La Cruz	Philadelphia	35 43 N.	73 55 W.	28	8a, 28	28	991.2	E	NE, 9	N	NE, 11	E-N.
Gulfdise, Am. M. S.	Port Arthur	Boston	35 45 N.	74 06 W.	28	10a, 28	29	987.8	E	N, 8	NW	N, 8	E-NNW.
Borinquen, Am. S. S.	New York	San Juan	35 24 N.	72 06 W.	28	1p, 28	28	984.1	SW	WSW, 10	NW	WSW, 10	SW-NW.
Mormacrey, Am. S. S.	Trinidad	New York	35 00 N.	71 14 W.	28	4p, 28	29	987.5	SW	W, 8	NW	NW, 9	W-NW.
Hamilton, U. S. C. G.	On Station No. 1	do	38 36 N.	59 30 W.	29	5a, 29	29	994.6	SSW	SSW, 8	WSW	SSW, 9	SSW-WSW.
Do	do	do	39 06 N.	58 12 W.	30	12m, 30	31	990.5	SE	W, 5	WSW	SW, 9	SE-W-NW.
NORTH PACIFIC OCEAN													
Lahaina, Am. S. S.	San Francisco	Honolulu	35 48 N.	126 24 W.	1	4p, 1	2	1,007.8	W	SW, 6	W	W, 8	SW-WSW.
Arizonan, Am. S. S.	Balboa	Los Angeles	15 36 N.	94 24 W.	1	4p, 1	1	1,011.5	NNW	N, 8	NNE	NNE, 8	NNW-NNE.
Illinois, Am. S. S.	Tacoma	Shanghai	46 24 N.	155 00 E.	1	4a, 2	2	978.0	E	SW, 6	WNW	NW, 8	SW-N.
Admiral Cole, Am. S. S.	Cebu, P. I.	Los Angeles	34 30 N.	144 30 W.	2	2a, 2	3	1,009.8	W	W, 6	NNW	NNW, 8	S-WNW.
Lahaina, Am. S. S.	San Francisco	Honolulu	34 00 N.	131 00 W.	2	4a, 3	3	998.6	WSW	WSW, 8	WSW	WSW, 10	WSW-NW.
Mapele, Am. S. S.	Kaanapali, H.	San Francisco	33 04 N.	135 49 W.	2	12p, 2	4	1,006.4	W	WNW, 9	NNW	WNW, 9	WNW-NNW.
Makua, Am. S. S.	Honolulu	do	30 24 N.	142 24 W.	2	2a, 2	3	1,013.5	NW	SW, 5	NNW	NW, 9	SW-NW.
La Placencia, Am. S. S.	Oleum, Calif.	Honolulu	35 16 N.	128 31 W.	2	1p, 3	4	992.6	SE	WNW, 9	NNW	NW, 9	SW-NW.
Illinois, Am. S. S.	Tacoma	Shanghai	42 30 N.	143 00 E.	4	2a, 5	5	1,005.4	W	WSW, 8	W	WSW, 8	
Lahaina, Am. S. S.	San Francisco	Honolulu	29 06 N.	142 48 W.	6	8a, 6	6	1,011.2	W	WNW, 5	NNW	NW, 8	WNW-NW.
Mauna Loa, Am. S. S.	Port Townsend	do	41 00 N.	135 00 W.	6	3p, 6	7	1,009.1	ESE	SE, 8	SSW	SE, 8	SE-SSE.
Aurora, Am. M. S.	Vladivostok	Los Angeles	44 54 N.	155 54 E.	6	9p, 6	7	996.6	W	W, 10	NW	NW, 10	W-NW.
La Placencia, Am. S. S.	Oleum, Calif.	Honolulu	29 14 N.	141 47 W.	7	2p, 7	7	1,007.8	NNW	NNW, 9	N	NNW, 9	None.
Makaweli, Am. S. S.	Honolulu	San Francisco	29 53 N.	143 38 W.	5	2p, 8	8	1,015.6	NW	N, 7	NNE	NNW, 9	N-NNE.
California Standard, Pan. M. S.	Yokohama	do	43 15 N.	178 38 E.	8	6a, 8	8	987.1	NW	NW, 8	N	NNW, 10	WSW-NW.
Hawaiian, Am. S. S.	Balboa	San Diego	16 00 N.	94 24 W.	8	2p, 8	8	1,010.5	NNW	NNW, 9	NNE	N, 9	NNW-N.
Patricia Skakel, Am. S. S.	do	Los Angeles	13 55 N.	96 10 W.	8	4p, 8	8	1,011.9	N	NNE, 6	NNE	NNE, 8	NNE-NE.
McKeesport, Am. S. S.	Hong Kong	do	32 12 N.	161 06 E.	8	11a, 9	9	1,012.3	S	S, 8	W	S, 8	S-W.
Aurora, Am. M. S.	Vladivostok	do	47 30 N.	168 24 E.	9	8p, 9	9	992.9	S	W, 3	W	S, 10	S-W.
Collingsworth, Am. S. S.	Tandoc, P. I.	do	29 12 N.	170 18 E.	11	11p, 10	14	1,016.6	WNW	SW, 5	N	NNW, 9	S-W.
McKeesport, Am. S. S.	Hong Kong	do	32 48 N.	179 54 W.	12	12p, 11	12	1,023.3	NNW	WNW, 6	NNW	NNW, 8	
Makaweli, Am. S. S.	Honolulu	San Francisco	34 24 N.	133 12 W.	10	6a, 12	13	1,009.5	NW	N, 9	N	NNW, 9	NNW-NNE.
Cuba Maru, Jap. M. S.	Yokohama	Seattle	35 45 N.	144 00 E.	11	2p, 12	12	1,000.0	S	S, 8	N	S, 9	S-N.
Kiyo Maru, Jap. M. S.	Dairen	Los Angeles	45 05 N.	175 15 W.	18	4p, 18	19	984.3	W	WNW, 11	WNW	W, 11	W-WNW.
Texmar, Am. S. S.	Los Angeles	Balboa	9 38 N.	86 32 W.	19	2a, 20	20	1,008.5	ENE	NE, 5	NE	NE, 8	
Paul Shoup, Am. S. S.	Ventura	San Francisco	35 39 N.	121 36 W.	20	6p, 20	20	1,017.3	NW	NW, 8	NW	NW, 8	None.
Genyo Maru, Jap. M. S.	Kobe	Los Angeles	36 00 N.	143 00 E.	20	12m, 19	20	992.7	SSW	SSW, 4	W	NW, 9	
Gyoko Maru, Jap. S. S.	Yokohama	Willapa	49 42 N.	154 00 W.	22	1a, 22	22	995.9	N	N, 7	N	N, 8	None.
Collingsworth, Am. S. S.	Tandoc, P. I.	Los Angeles	34 30 N.	122 18 W.	22	4p, 23	23	1,015.6	N	N, 7	N	N, 8	None.
Schoharie, Am. S. S.	Honolulu	do	30 18 N.	137 12 W.	26	4a, 27	28	1,010.5	NNW	NW, 8	NW	NW, 8	
Neosho, U. S. S.	do	Seattle	43 42 N.	129 06 W.	26	4a, 29	28	998.3	NNW	E, 3	NNW	NNW, 9	
West Portal, Am. S. S.	Los Angeles	Balboa	14 52 N.	94 51 W.	29	4p, 29	29	1,007.5	NE	N, 8	N	N, 9	
Matsonia, Am. S. S.	San Francisco	Honolulu	33 48 N.	134 18 W.	30	8a, 30	31	994.9	WSW	WSW, 9	NNW	W, 10	WSW-W.

1 February.

2 Position approximate.

3 April.

4 Barometer uncorrected.

WEATHER ON THE NORTH PACIFIC OCEAN

By WILLIS E. HURD

Atmospheric pressure.—With the movements of cyclones over northern waters in March 1941, many of the principal centers of low pressure entered or remained for several days over the western part of the Gulf of Alaska. Kodiak this month was close to the center of the Aleutian low, with a mean pressure of 997.2 millibars (29.45 inches), which is 8.2 millibars (0.24 inch) below the March normal. Low barometer prevailed throughout higher latitudes, with a secondary center west of the Aleutian Islands.

From the California coast southwestward about two-thirds of the way to the Hawaiian Islands, several depressions of the month contributed to lower the average barometer several millimeters under the normal. The North Pacific anticyclone lay to the westward of the depressed region, and from Honolulu across Midway Island to the coast of China, the barometer averaged above the normal for March.

TABLE 1.—Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, March 1941, at selected stations

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	Millibars	Millibars		Millibars	
Barrow	1,025.1	+4.1	1,040	25	1,006	7
Dutch Harbor	998.9	-6.9	1,021	9	978	30
St. Paul	1,003.2	-3.6	1,029	9, 13	981	2
Kodiak	997.2	-8.2	1,016	13	984	4
Juneau	1,012.2	-1.7	1,029	9	998	20
Tatoosh Island	1,015.9	+1.3	1,034	8	989	1
San Francisco	1,013.9	-4.1	1,027	8	1,000	31
Mazatlan	1,013.1	-0.1	1,015	1-4, 11-12	1,010	22
Honolulu	1,019.0	+1.7	1,025	30	1,013	13
Midway Island	1,022.8	+4.5	1,028	14, 16-17, 31	1,002	23
Guam	1,012.3	-0.2	1,016	5	1,007	9
Manila	1,011.6	+0.6	1,016	5	1,009	9, 10, 17
Hong Kong	1,014.6	-0.6	1,022	4	1,010	23
Naha	1,016.6	+0.7	1,026	5	1,006	17
Titijima	1,017.8	+1.9	1,028	6	1,010	18
Petrovsk	1,004.1	-6.0	1,016	7	985	22

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observations.

Cyclones and gales.—Despite the depth of the Aleutian low, which gave evidence of much cyclonic activity in higher latitudes of the North Pacific in March 1941, there were only a few reports from ships to show the existence of gale-force winds along the northern steamship routes. Early in the month, rather severe storm conditions occurred in waters east of northern Japan and the Kuril Islands, accompanied by snow squalls to heavy snows from the 2d to 7th, as reported by several vessels. In connection with this storm, the American S. S. *Illinois*, near 46° N., 155° E., had a low barometer of 976 millibars (28.82 inches) on the 2d, followed by a northwest gale of force 8. The highest wind of record for the period was a westerly gale of force 10, reported by the American M. S. *Aurora* on the 6th, near 45° N., 156° E. On the 9th the *Aurora* ran into a further gale, of force 10 from the south, near 47½° N., 168° E.

In middle longitudes the only gales of consequence arising from passing cyclones of higher latitudes occurred on the 8th and 18th. Both were accompanied by moderately low barometer. The earlier, of force 10, was experienced by the Panamanian M. S. *California Standard*, near 43° N., 179° E.; the latter, of force 11—the highest of the month—by the Japanese M. S. *Kiyo Maru*, near 45° N., 175° W.

In middle latitudes northwesterly gales of force 9 were met in the high-pressure area north of Midway

Island on the 12th. A short distance out from Yokohama force 9 gales occurred on the 12th and 20th in cyclones of moderate intensity. Between southern Japan and Midway Island, isolated fresh gales were noted on the 1st, 8th, and 11th.

As in the preceding December and February, the stormiest part of the ocean in March was that between about 28° and 40° N., from the California coast westward to approximately 145° W. Several depressions affected this area between the beginning and ending of the month. The earliest gale, of force 8, on the 1st, occurred about 200 miles west of San Francisco, in connection with a low off the Oregon coast.

On March 2 a cyclone center appeared near 40° N., 140° W. It moved east-southeastward and on the 4th entered the middle California coast. The storm was only moderately deep, the American S. S. *La Placencia* reporting a barometer of 992.6 millibars (29.31 inches) on the 3d, accompanied by a northwest gale of force 9, near 35° N., 128½° W. The highest wind, of force 10 from west-southwest, was encountered by the American S. S. *Lahaina* late on the 2d, near 34° N., 130° W.

What appeared to be a secondary depression gathered on the 5th near 38° N., 148° W., at the southern extremity of a cyclone central over the Gulf of Alaska. From the 6th to the 14th it took a slow, meandering course, performing two distinct loops before finally entering the southern California coast. During the 6th to 8th the center oscillated between about 27° and 32° N., 140° and 135° W. To the westward lay a bank of high pressure. Between the high and the low strong northwesterly winds occurred, at times rising to force 8 and 9. The disturbance lost energy during the 9th and 10th, but on the 11th and 12th, it again exhibited local strength, with northwesterly gales of force 8 to 9 near 34°-35° N., 133° to 136° W.

On the 20th, 22d, and 23d strong northerly winds, at times rising to force 8, were experienced by vessels in the vicinity of Point Arguello. These occurred on the eastern edge of a high-pressure area lying off the California coast.

From the 26th to 31st another disturbance which formed west of California moved from approximately 35° N., 132° W., to about 40° N., 135° W., accompanied on the 26th and 27th by strong northwesterly winds, highest force 8 to 9, west of the center. The heaviest wind, a west gale of force 10, lowest barometer 994.9 millibars (29.38 inches), was reported on the 30th by the American S. S. *Matsonia*, near 34° N., 134° W.

Tehuantepecers and Papagayos.—Norther-type gales occurred in the Gulf of Tehuantepec as follows: of force 7 on the 14th and 15th; of force 8 on the 1st; and of force 9 on the 8th and 29th. Off the Costa Rican coast a northeasterly Papagayo of force 7 occurred on the 14th and one of force 8, on the 19th.

Fog.—Ships encountered a few scattered fogs on various parts of the ocean. In coastal waters they reported fog on 3 days off British Columbia; on 5 days off Washington; on 3 days off Oregon; and on 1 day off California.

FIJI HURRICANE OF FEBRUARY 20, 1941

By WILLIS E. HURD

Through kindness of Capt. E. R. Johanson, master of the American S. S. *Monterey*, a copy of "The South Sea Weekly—Special Hurricane Edition," of March 10, 1941, has been received, containing an account of the hurricane which struck the Fiji Islands on the 20th of the preceding February.

The storm was of a very erratic nature. It originated as a depression over northern Tonga several days prior to the 20th, crossed the Fiji Islands as still a weak low, backed later toward the Tongas, then returned to Fiji, intensifying with great rapidity. The high winds began from the south in the morning, and reached their greatest force from the north in the afternoon. The calm center crossed Levuka, beginning at about 11:45 a. m. and continuing for nearly an hour. During this period the sun shone for a few minutes. The lowest barometer, read as the light central winds were giving place to heavy northerly gales, was 28.37 inches (960.7 millibars). At Suva the maximum velocity was 110 miles. The rainfall at Suva amounted to 6.49 inches for the 24-hour period 8 a. m. of the 20th to 8 a. m. of the 21st.

Considerable damage was done in various parts of the islands to houses, fruit trees, and crops. Several small vessels were stranded on the reefs and beaches, and some were destroyed. A few lives were reported lost.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

The precipitation pattern for March coincided very closely with that for February. As in February, precipitation was well above normal in the States from Texas westward to the ocean. All of the States in the northern, central, and eastern parts of the country were below normal except for South Carolina and Florida which were above normal. The central Mississippi and Ohio Valleys again were the driest sections of the country. River stages were unusually low in these sections. The Mississippi River at Vicksburg, Miss., had lower stages than previously recorded in March since 1895.

High water and light to moderate flooding continued in much of eastern Texas, in Arizona, and in California. These floods and others that occurred during the month are given below.

Atlantic Slope drainage.—The weather remained cold during most of the month with only short periods of high temperature. The snow cover in the Northeast was reduced somewhat with only moderate rises in the streams. At the end of the month the average snow depth over the Connecticut Basin was 9.6 inches with a water content of 3.1 inches; in the Susquehanna Basin above Towanda, Pa., the snow depth averaged 3.5 inches and below Towanda, only a trace.

Slight flooding occurred in the Neuse and Savannah Rivers during the month. In the Neuse River, flood stage was exceeded at Smithfield, N. C., on March 30. The Savannah River experienced two rises to slightly above flood stage at Clio, Ga., and Ellenton, S. C. No damage was reported.

East Gulf of Mexico drainage.—Heavy rains on March 6-7, averaging about 3 inches over the Black Warrior and Tombigbee Rivers and 2.5 inches over the Pearl and Pascagoula Rivers, resulted in substantial rises in these rivers. Minor flooding occurred in the Tombigbee River below Demopolis, Ala., and at a few points in the Pearl and Pascagoula Rivers. The damage in the Tombigbee is estimated at \$2,000, and in the Pearl and Pascagoula at \$13,000.

Upper Mississippi Basin.—Flooding occurred in the Zumbro-Whitewater Rivers in Minnesota and in the Rock River in Illinois during the latter part of the month. No damage was reported except for a loss amounting to \$2,500 in the Zumbro-Whitewater Basin.

Missouri Basin.—Ice broke up in the Heart River which drains into the Missouri River just below Bismarck, N. Dak., on March 26. During the night the Heart River rose considerably, the water being backed up by the solid ice in the Missouri. Some bottom lands were flooded but no damage resulted.

Flood stages were reached and exceeded in the Big Sioux and Floyd Rivers. Because of the earliness of the season there was no appreciable damage.

The following report was submitted by the official in charge, Helena, Mont.:

An earlier-than-usual spring run-off of water from melted snow and ice in the upper drainage basin of the west and north forks of the Milk River was dammed by ice jams until March 21, when a breakup began. The water was released and overflowed the banks and inundated a large tract of land near the mouth of the streams in the vicinity of Chinook, Blaine County. Flood waters continued on the 22d, cresting on the 23d. When the flood waters reached the Milk River on the 23d, ice jams formed in that stream and caused flooding.

Most of the damage resulting from the flood occurred in the vicinity of Chinook, with lesser damage occurring near Harlem. The aggregate damage has been estimated at \$10,000.

Red Basin.—Heavy rains in the watershed of the Ouachita and Little Missouri Rivers on March 6-7 caused flood stages in the Ouachita at Camden, Ark., from March 9-14 with only slight damage resulting.

River stages continued high in the Sulphur River from rains occurring at the end of February and again on March 6-7. The river crested at Ringo Crossing, Tex., on March 8 at a stage of 28.5 feet and at Naples, Tex., on March 11 at 27.6 feet. Losses were reported in the previous report.

West Gulf of Mexico drainage.—Rains were again above normal in eastern Texas during March and river stages continued high. Minor flooding occurred but with no appreciable damage.

Colorado River Basin.—Heavy rains, principally over the Verde River watershed, caused a rise in that river and in the Salt River into which it flows, the Salt River cresting at a stage of 7.4 feet at Phoenix, Ariz., on March 15. The flood was of a minor nature but was of much interest due to the fact that there had been no flow in the Salt River since the recent construction of Bartlett Dam on the Verde River which had contributed to the flood problem in Phoenix prior to the construction of that dam.

As a result of warnings issued no losses were experienced and it is estimated that the savings as the result of the warnings approximated \$5,000.

Rains were heavy in central Arizona during the middle of March resulting in a local flood in Pinal Creek and considerable damage to highways. Two lives were lost in connection with a sudden rise in Clear Creek, a tributary of the Little Colorado River near Winslow, Ariz.

Pacific Slope drainage.—Stream discharges were high in most of California during the month. A surplus of water moved into the Tulare Lake Basin and additional farm lands were inundated. A mild flood occurred in the lower Eel River on March 1-2.

Another flood in the long series that marked the 1940-41 season began in the Sacramento Valley on the last day of February. The official in charge, Sacramento, Calif., reports as follows:

Following the high water that occurred in this valley during the second week in February, frequent rains kept the water levels moderately high until near the end of the month, when flood conditions again developed in the upper Sacramento River.

During the closing days of February an unusually extensive system of low pressure which was charted off the Pacific coast caused

general rains over northern California, with heavy amounts beginning in Shasta County on the 27th. On the morning of the 28th, an intensive secondary cyclonic center was located about 150 miles southwest of the San Francisco Bay, and during its slow advance northward that day, winds of gale force occurred in the open valleys. At the Sacramento Municipal Airport a current velocity of 52 miles an hour was registered, while at the city office 41 miles represented the extreme velocity.

The high winds caused some damage to power and telephone lines, trees, farm buildings, etc., locally in the San Joaquin and Sacramento Valleys.

The upper Sacramento River began to rise rapidly on the morning of the 28th, and flood warnings were issued during the day for the river from Red Bluff to the mouth of Stony Creek. On March 1 the crest stage at Red Bluff was 25.6 feet, or 2.6 feet above the flood stage and 0.9 foot above that which occurred in the early part of February this year.

Stony Creek was especially high, as indicated by the unusually high stage of 12.4 feet at St. John. This represents the highest water there since the record high of 13.9 feet which occurred just 1 year ago. This creek was responsible for the washing out of the east approach of the bridge over Stony Creek on the Orland-Chico highway.

Despite the fact that both the Sacramento River at Red Bluff and Stony Creek at St. John carried more water than they did during the flood of the forepart of February, the resultant maximum gage heights at Hamilton City and Colusa were slightly lower than in the first February freshet this year. This is mainly true, it is believed, because the east-side creeks, such as Deer, Mill, and Antelope, were not discharging so heavily.

On March 2 it was reported that a 50-foot break occurred in the east-side levee at Goodman Ranch, about 5 miles north of Butte City, allowing water from the Sacramento River to escape more rapidly into the already heavily flooded Butte Basin.

During the peak of the flood Butte City was isolated because of the flooding of the highways in that vicinity. The town of Tehama also suffered a similar experience. Many highways throughout the valley were temporarily closed either by overflow water or the accumulation of local drainage in low places.

The State Highway Department reported that cloudburst conditions in mountain areas caused heavy damage locally by washing out highway embankments. The principal areas affected were the Feather River Canyon, the Sacramento River Canyon, and the highway along Willow Creek, in Shasta County, on the road from Reading to Weaverville. Other damage was done in places by mountain streams.

Excessive run-off during the present flood period occurred only in the upper Sacramento drainage area. The American and Feather Rivers, as was the case in previous floods this season, were not exceptionally high.

However, on March 3, the slowly rising river at Sacramento occasioned the closing of the flood-control gages on Highway 40 at North Sacramento. The Sacramento River reading at that time was 26.2 feet, but about 1 foot of water had been held back along the low section of the highway by the use of sand bags.

The lower San Joaquin River reached its peak on March 6 with a stage of 15.5 feet at Lathrop, or 1.5 feet below the flood stage there. In the vicinity of Durham Ferry bridge, mostly on the River Junction Farms, there was considerable flooding of lowland, caused by old levee breaks (those of previous years) which had not been repaired. The actual losses sustained in this area were not heavy because the water was not high enough to affect farm houses and also because crop planting, in general, had purposely been delayed.

The flooded lowlands throughout the valleys represented approximately the same areas that were previously flooded this season, including the island tracts of Little Holland, Liberty, and Prospect in the Yolo bypass. As the earlier flood waters had only partially receded, the actual additional damage to inundated lands was comparatively light, although the resultant loss due to the continuously water-covered areas, thus delaying and preventing the planting of seasonal crops, was considerable and difficult to evaluate. Also the sustained high water on the levees resulted in seepage conditions that killed fruit trees in many lowland orchards adjacent to the river.

The total losses have been estimated at about \$600,000.

TABLE OF FLOOD LOSSES AND SAVINGS DURING
MARCH 1941

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total losses	Savings as result of flood warnings
EAST GULF OF MEXICO DRAINAGE							
Tombigbee River	\$1,000				\$1,000	\$2,000	\$2,500
Pascagoula River					10,000	10,000	6,000
Pearl River					3,000	3,000	1,500
MISSISSIPPI SYSTEM							
<i>Upper Mississippi Basin</i>							
Zumbro-Whitewater Rivers	2,215		\$285			2,500	
<i>Missouri Basin</i>							
Milk River in Montana						10,000	
<i>Red Basin</i>							
Ouachita River				\$500	1,000	1,500	5,500
WEST GULF OF MEXICO DRAINAGE							
Guadalupe River							1,200
GULF OF CALIFORNIA DRAINAGE							
Salt River ¹							5,000
PACIFIC SLOPE DRAINAGE							
San Joaquin River	8,000	\$2,130	20,000			30,130	
Sacramento River	450,000	40,000	70,000		5,000	565,000	5,000

¹ Figures on losses not available.

FLOOD-STAGE REPORT FOR MARCH 1941

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
Neuse: Smithfield, N. C.	13	29	(1)	13.8	30
Savannah: Clio, Ga.	11	16	18	11.2	17
EAST GULF OF MEXICO DRAINAGE					
Tombigbee:					
Lock No. 4, Demopolis, Ala.	39	9	14	44.2	12
Lock No. 3, Whitfield, Ala.	33	7	17	46.4	12
Lock No. 2, Pennington, Ala.	46	9	15	48.0	13
Lock No. 1, Saltpa, Ala.	31	9	18	33.4	14-15
Chickasawhay: Shubuta, Miss.	26	8	9	27.0	9
Pascagoula: Merrill, Miss.	22	11	13	22.4	12
Pearl:					
Jackson, Miss.	18	{ 8	19	22.4	15
Pearl River, La.	12	{ 21	24	19.8	22
		{ 11	18	13.6	14
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Rock: Moline, Ill.	10	22	27	10.6	24
Missouri Basin					
Floyd: James, Ia.	14			16.6	6
Big Sioux: Akron, Ia.	12	{		13.2	13
				13.2	25
Red Basin					
Ouachita: Camden, Ark.	26	8	15	29.5	11
Sulphur:					
Ringo Crossing, Tex.	20	{ (2)	1		
Naples, Tex.	22	{ 6	10	28.5	8
		{ 2	17	27.6	11
WEST GULF OF MEXICO DRAINAGE					
Sabine: Logansport, La.	25	11	14	25.8	13
Trinity:					
Trinidad, Tex.	28	{ (2)	13	32.2	10
Long Lake, Tex.	40	{ 1	4	40.9	3
		{ 12	16	41.0	14
Liberty, Tex.	24	{ (2)	2	24.3	1
		{ 7	26	26.2	13
Guadalupe: Victoria, Tex.	21	{ 19	20	22.2	19
		{ 20	23	25.9	22
PACIFIC SLOPE DRAINAGE					
Sacramento Basin					
Stony Creek: St. John, Calif.	12	1	1	12.4	1
Sacramento:					
Red Bluff, Calif.	23	{ (2)	2	25.55	1
Hamilton City, Calif.	20	{ 1	1	20.1	1
Knights Landing, Calif.	30	{ 1	8	31.7	4
Eel Basin					
Eel: Fernbridge, Calif.	17.5	1	2	18.05	1

¹ Continued into next month.

² Continued from preceding month.

CLIMATOLOGICAL DATA

CONDENSED CLIMATOLOGICAL SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS

[For description of tables and charts, see REVIEW, January, pp. 30-31]

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Section	Temperature						Precipitation					
	Section average	Departure from the normal	Monthly extremes				Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date	Station	Amount	Station	Amount
Alabama.....	50.7	-5.3	Andalusia.....	87	26	Madison.....	15	1	Helena.....	9.41	Waterloo.....	2.19
Arizona.....	50.1	-1.6	Wellton.....	89	23	Ft. Valley.....	3	8	Pinal Ranch.....	8.63	Tombstone.....	.13
Arkansas.....	47.5	-5.1	Texarkana.....	80	3	Devils Knob.....	13	17	Hope.....	6.76	Fayetteville Exp.....	.47
California.....	52.6	+1.2	Indio.....	89	26	2 stations.....	-2	15	Mount Wilson.....	17.74	Cow Creek.....	.09
Colorado.....	34.1	-1.5	Akron.....	80	1	Spicer.....	-29	12	Wolf Creek Pass.....	10.87	Fort Lupton.....	.53
Florida.....	60.4	-4.8	Davenport.....	90	20	Hilliard.....	22	2	DeFuniak Springs.....	9.85	Ponte Vedra Beach.....	.65
Georgia.....	50.1	-6.1	Albany.....	82	25	2 stations.....	16	18	Americus.....	6.68	Savannah No. 1.....	2.54
Idaho.....	39.8	+3.9	Arrowrock.....	81	17	Island Park Dam.....	-13	14	Deception Creek.....	2.37	2 stations.....	.00
Illinois.....	36.8	-4.0	3 stations.....	72	13	Freeport.....	-5	17	Chicago (Airport).....	3.49	Chester.....	.32
Indiana.....	35.9	-4.7	2 stations.....	76	20	La Porte.....	-2	17	Hobart.....	1.90	Shelbyville.....	.23
Iowa.....	33.5	-1.1	do.....	71	30	3 stations.....	-10	18	Postville (near).....	2.50	Denison.....	.18
Kansas.....	40.4	-3.0	St. Francis.....	81	11	2 stations.....	10	18	Pratt.....	2.33	Quinter.....	.21
Kentucky.....	40.5	-5.8	Middlesboro.....	74	22	Lynch (near).....	2	1	Pikeville.....	3.45	Rumsey.....	.43
Louisiana.....	54.8	-5.8	3 stations.....	84	16	Grand Cane.....	26	11	Lake Arthur (near).....	11.64	Pollock (near).....	2.60
Maryland-Delaware.....	36.9	-5.7	2 stations.....	69	3	2 stations.....	-8	2	2 stations.....	3.48	2 stations.....	1.21
Michigan.....	25.9	-3.6	do.....	58	23	Kenton.....	-22	6	Holland.....	2.85	Ludington.....	.11
Minnesota.....	25.5	-1.0	Redwood Falls.....	64	30	Meadowlands.....	-29	18	Rochester.....	2.54	Grand Marais.....	.10
Mississippi.....	51.0	-5.9	3 stations.....	80	14	5 stations.....	20	1	Laurel.....	1.92	Hernando.....	1.77
Missouri.....	40.5	-3.4	Sikeston.....	78	21	Unionville.....	7	1	Neosho.....	2.98	2 stations.....	.10
Montana.....	35.2	+3.9	Forsyth.....	75	31	2 stations.....	-16	13	Mystic Lake.....	1.94	Ennis.....	.00
Nebraska.....	35.0	-1.5	2 stations.....	80	11	Atkinson.....	-4	13	Hay Springs.....	1.90	Overton.....	.23
Nevada.....	42.9	+2.3	Overton.....	102	31	Tem Plute.....	0	15	Charleston Ranger Station.....	3.52	2 stations.....	.00
New England.....	27.9	-4.2	2 stations.....	58	23	First Conn. Lake, N. H.....	-21	13	Bar Harbor, Me.....	6.80	Bethlehem, N. H.....	.81
New Jersey.....	34.5	-4.7	do.....	63	31	Charlotteburg.....	3	18	Toms River.....	5.95	Culvers Lake.....	1.44
New Mexico.....	41.4	-2.3	Carlsbad.....	85	1	Eagle Nest.....	-17	10	Lee Ranch.....	8.06	San Marcial.....	.40
New York.....	26.4	-5.5	Poughkeepsie.....	62	31	Stillwater Reservoir.....	-24	7	Whiteface Mountain.....	4.09	Poughkeepsie.....	.95
North Carolina.....	44.0	-5.9	Louisburg.....	81	23	Mount Mitchell.....	-6	18	Lumberton.....	7.56	Elkin.....	1.96
North Dakota.....	24.5	+7	5 stations.....	68	29	Edmore.....	-25	17	Cavalier.....	1.36	Bowman.....	T
Ohio.....	33.4	-5.3	2 stations.....	69	20	2 stations.....	3	17	Canton.....	2.55	Put-in-Bay.....	.31
Oklahoma.....	46.5	-4.3	Buffalo.....	81	31	Kenton.....	10	11	Carnasaw Tower.....	2.85	Norman.....	.19
Oregon.....	41.1	+3.5	Powers.....	84	10	Olive Lake.....	-2	13	Brookings.....	4.63	Andrews.....	T
Pennsylvania.....	31.8	-5.7	New Castle.....	67	24	Lawrenceville.....	-10	14	Zionsville.....	4.57	McKeesport.....	.57
South Carolina.....	48.4	-6.2	McColl No. 2.....	78	20	Caesars Head.....	12	1	Ferguson.....	6.91	Columbia.....	2.37
South Dakota.....	31.1	-2	Vivian.....	73	30	Britton.....	-12	17	Harvey's Ranch.....	2.09	Ludlow.....	.03
Tennessee.....	43.9	-5.5	Etowah.....	77	23	Gatlinburg.....	7	18	Tellico Plains.....	5.60	Wildersville.....	.63
Texas.....	52.7	-5.8	Laredo.....	94	31	Pampa.....	13	17	Bon Wier.....	7.29	Presidio.....	.05
Utah.....	39.6	+1.1	2 stations.....	75	17	2 stations.....	-5	12	Mount Baldy Ranger Station.....	5.45	Bonanza.....	.36
Virginia.....	39.9	-5.8	Danville.....	74	23	Big Meadows.....	-2	18	Pennington Gap.....	4.18	Radford.....	.54
Washington.....	47.2	+5.6	South Bend.....	80	27	2 stations.....	12	12	Quinalt.....	7.62	Mansfield (near).....	.02
West Virginia.....	34.8	-7.5	Seneca State Forest.....	72	22	Alpena.....	-7	2	Mullens.....	4.74	Shinnston.....	.71
Wisconsin.....	25.4	-3.8	3 stations.....	60	30	Prentice (near).....	-28	18	Williams Bay.....	2.36	Oconto.....	.38
Wyoming.....	30.9	+9	do.....	72	29	Foxpark.....	-35	12	Quaking Aspen Creek.....	3.06	Deaver.....	.05
Alaska (February).....	16.5	+9.6	do.....	57	12	Fort Yukon.....	-42	25	Latouche.....	21.87	Big Delta.....	.00
Hawaii.....	68.7	+1	2 stations.....	89	19	Haleakala (Maui).....	28	29	Kukul.....	46.00	5 stations.....	.00
Puerto Rico.....	75.1	+1.8	do.....	97	12	Garzas.....	50	4	La Mina (El Yunque).....	7.02	Cayey.....	.23

1 Other dates also.

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments			Pressure			Temperature of the air										Precipitation			Wind					Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month			
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max. + mean min. +2	Departure from normal	Maximum	Date	Mean minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of dew point	Mean relative humidity	Total	Departure from normal	Days with 0.01 inch or more	Average hourly velocity	Prevailing direction	Maximum velocity									
																							Miles per hour	Direction						Date		
New England																																
Eastport	75	67	85	29.68	29.77	-0.16	27.8	-1.1	48	23	34	2	18	21	21	25	20	74	1.83	-2.0	10	12.9	nw.	43	ne.	12	12	4	15	5.5	13.9	T
Greenville, Maine	1,070	6	41	28.62	29.82	21.4	47	15	31	-10	13	12	39	19	15	15	3.38	-1.6	14	8.7	nw.	29	w.	17	16	4	11	4.5	19.8	T		
Portland, Maine	103	5	25	29.71	29.82	-1.4	27.3	-4.5	50	23	37	0	13	17	40	24	18	69	2.24	-1.6	11	8.0	nw.	23	w.	26	10	8	13	4.9	15.9	T
Concord	289	54	72	29.63	29.86	-1.4	29.8	-1.0	52	28	38	0	13	21	40	24	18	68	1.44	-1.6	9	9.1	n.	26	nw.	19	7	8	16	6.3	27.7	T
Burlington	403	11	48	29.46	29.92	-0.8	23.6	-5.5	44	16	32	-3	18	16	32	20	16	77	2.13	-1.1	12	7.7	n.	24	ne.	4	7	8	16	6.5	26.6	T
Northfield	876	12	60	28.91	29.89	-1.1	22.2	-4.2	46	14	32	-14	13	12	46	20	60	3.40	-2.3	13	13.6	nw.	39	ne.	8	10	8	13	5.5	13.1	0	
Boston	124	38	62	29.71	29.85	-1.2	33.4	-2.2	56	23	40	12	18	26	33	28	20	60	3.40	-2.3	13	13.6	nw.	39	ne.	8	10	8	13	5.5	13.1	0
Nantucket	12	14	90	29.83	29.84	-1.4	34.2	-1.3	48	23	40	16	18	28	32	30	25	73	3.82	-1.1	12	16.4	w.	51	ne.	1	14	3	14	5.2	11.2	0
Block Island	26	11	46	29.84	29.87	-1.1	33.5	-1.9	48	23	39	15	18	28	32	30	25	71	2.25	-1.6	9	19.4	nw.	52	ne.	1	17	1	13	4.9	6.9	0
Providence	159	57	78	29.70	29.88	-1.0	34.0	-1.7	57	23	42	11	18	26	32	28	21	64	3.54	-1.0	10	15.1	nw.	50	nw.	15	5	11	4.7	19.5	0	
Hartford	159	5	44	29.72	29.90	-0.9	31.6	-3.4	55	23	41	5	13	22	35	27	21	68	2.10	-1.8	10	11.3	n.	40	nw.	19	12	4	15	5.7	18.7	0
New Haven	107	5	39	29.79	29.91	-0.8	34.0	-1.8	54	23	42	11	18	26	32	28	21	65	2.10	-1.4	10	10.5	nw.	35	ne.	8	16	1	14	4.8	15.1	0
Middle Atlantic States																																
Albany	97	26	40	29.82	29.93	-0.8	27.9	-4.8	49	23	36	1	13	20	38	23	17	66	1.85	-8	10	12.4	w.	47	w.	19	8	9	14	6.2	19.3	0
Binghamton	871	57	79	29.03	29.99	-0.3	28.3	-4.3	51	31	38	4	18	19	39	24	20	76	2.65	-0	13	7.6	nw.	30	nw.	18	5	10	16	6.8	27.5	T
New York	314	415	454	29.57	29.92	-0.8	35.7	-2.0	58	27	44	14	18	27	34	29	20	56	2.52	-1.1	11	18.3	nw.	61	nw.	18	15	3	13	4.9	15.9	0
Harrisburg	374	30	49	29.58	29.99	-0.4	36.0	-2.9	60	31	45	13	18	27	35	30	21	59	2.10	-0.9	7	9.8	nw.	35	nw.	18	9	8	14	6.0	16.6	0
Philadelphia	114	174	367	29.84	29.97	-0.5	37.4	-3.4	57	31	45	16	18	30	32	31	24	66	2.80	-0.6	10	14.5	nw.	38	n.	1	14	6	11	4.6	11.3	0
Reading	323	47	306	29.62	29.98	-0.6	30.4	-4.4	56	23	44	14	18	28	34	29	20	55	2.68	-0.8	10	13.8	nw.	46	e.	11	15	6	10	4.6	17.6	0
Scranton	805	72	104	29.04	29.96	-0.6	30.4	-3.5	54	31	38	10	18	23	32	21	1.64	-1.6	10	7.9	nw.	32	nw.	18	8	10	13	6.0	20.7	0		
Atlantic City	52	37	172	29.90	29.96	-0.6	36.8	-1.8	54	22	44	17	18	29	32	31	24	62	2.86	-7	6	17.9	w.	54	ne.	8	15	6	10	4.5	5.7	0
Trenton	190	89	107	29.74	29.96	-0.6	35.5	-3.5	58	31	43	16	18	28	31	30	22	60	2.26	-1.1	10	10.8	nw.	30	w.	18	11	9	11	5.2	9.4	0
Baltimore	123	100	215	29.85	29.99	-0.4	40.1	-2.2	68	3	49	15	18	32	34	33	23	54	2.20	-1.5	6	12.5	nw.	40	sw.	1	10	9	12	5.4	12.1	0
Washington	112	62	85	29.87	30.00	-0.4	39.8	-2.8	68	3	49	15	18	31	32	33	22	52	2.57	-1.2	6	9.2	nw.	28	nw.	4	11	9	11	5.1	11.2	0
Cape Henry	18	8	54	29.97	29.99	-0.2	41.8	-4.8	68	3	49	24	1	34	34	31	70	2.09	-8	8	14.6	nw.	42	nw.	30	11	11	9	4.9	2.5	0	
Lynchburg	686	144	184	29.27	30.03	-0.2	42.8	-4.5	69	20	54	19	18	32	36	35	24	52	1.47	-2.1	6	8.9	nw.	31	nw.	12	11	7	13	5.4	6.2	0
Norfolk	91	80	125	29.90	30.01	-0.2	44.0	-4.2	68	3	53	21	1	35	34	36	30	68	2.50	-1.3	8	11.6	nw.	30	nw.	29	11	5	15	5.7	3	0
Richmond	144	11	52	29.85	30.01	-0.3	42.0	-5.2	69	20	53	21	5	31	40	34	25	60	2.43	-1.2	9	9.9	nw.	27	w.	3	12	10	9	5.0	5.9	0
South Atlantic States																																
Asheville	2,253	89	104	27.65	30.07	+0.1	40.7	-4.2	69	21	52	15	18	30	38	33	26	65	3.18	-8	12	9.8	nw.	29	nw.	18	8	7	16	6.5	4.4	0
Charlotte	779	63	86	29.18	30.02	-0.3	46.3	-4.1	70	21	57	24	18	36	35	37	30	65	3.58	-6	12	8.3	sw.	29	sw.	15	6	13	12	6.0	1.3	0
Greensboro	896	6	56	29.07	30.03	-0.2	42.2	-5.3	70	21	54	16	2	30	43	35	27	63	3.52	-10	10.0	sw.	34	nw.	18	9	13	9	5.3	T	0	
Hatteras	11	5	50	29.99	30.00	-0.4	45.9	-6.1	64	24	52	26	1	40	24	42	33	76	4.21	-0	7	14.9	n.	36	nw.	1	10	11	10	5.2	T	0
Raleigh	376	27	69	29.61	30.02	-0.3	44.8	-5.4	74	20	56	23	18	33	38	37	28	59	4.04	+2	9	10.9	sw.	34	nw.	17	8	9	14	6.1	1.0	0
Wilmington	72	73	107	29.95	30.03	-0.2	49.0	-4.3	70	20	59	27	1	40	30	42	34	64	3.03	-1	9	10.7	nw.	33	sw.	11	10	10	11	5.5	T	0
Charleston	48	11	92	29.98	30.03	-0.3	51.4	-6.0	69	24	58	28	1	44	23	44	38	69	3.55	+5	13	11.3	nw.	33	n.	14	4	12	15	6.8	T	0
Columbia, S. C.	347	70	91	29.66	30.04	-0.2	49.6	-5.6	71	25	60	25	2	39	32	42	35	66	2.37	-1.0	12	9.4	n.	25	sw.	3	10	13	8	5.0	T	0
Greenville, S. C.	1,040	70	78	29.82	30.03	-0.3	50.5	-5.5	72	4	62	26	1	39	34	42	34	63	4.84	+7	13	6.9	nw.	24	nw.	13	9	10	12	5.9	T	0
Augusta	182	62	77	29.84	30.03	-0.3	50.5	-5.5	72	4	62	26	1	39	34	42	34	63	4.84	+7	13	6.9	nw.	24	nw.	13	9	10	12	5.9	T	0
Savannah	65	73	152	29.97	30.04	-0.2	54.2	-4.8	77	4	64	27	1	45	39	45	39	68	2.54	-5	12	11.7	nw.	31	nw.	17	8	12	11	5.8	0	0
Jacksonville	43	86	110	30.00	30.05	-0.1	57.8	-4.8	78	21	68	28	1	48	31	48	43	71	2.18	-7	8	8.5	nw.	25	sw.	8	7	7	17	6.3	0	0
Florida Peninsula																																
Key West	21	10	64	30.00	30.02	-0.3	69.4	-3.2	84	21	75	52	2	64	22	63	61	80	3.12	+1.7	6	10.5	ne.	35	w.	9	9	16	6	5.2	0	0
Miami	25	124	168	30.00	30.02	-0.6	67.4	-2.8	84	27	74	38	2	60	26	59	56	79	5.01	+2.8	6	9.4	se.	32	s.	26	8	15	8	5.4	0	0
Tampa	35	5	61	30.01	30.04	-0.3	61.7	-5.1	78	23	70	39	1	54	26	55	51	77	4.43	+2.0	8	11.6	n.	29	nw.	8	5	17	9	5.9	0	0
East Gulf States																																
Atlanta	1,173	5	72	29.79	30.04	-0.2	46.6	-5.4	67	26	57	22	1	36	34	40	33	65	4.05	-	15	11.7	nw.	41	s.	7	9	7	15	6.2	0	0
Macon	370	79	87	29.64	30.04	-0.2	50.0	-6.7	73	4	61	25	1	39	37	43	36	67	3.93	-1.0	13	8.4	nw.	24	nw.	4	8	9	14	6.1	0	0
Thomasville	273	49	58	29.78	30.08	+0.02	45.8	-	70	26	1	26	1	42	27	51	47	79	6.01	-	10	8.9	nw.	29	sw.	7	6	13	12	6.4	0	0
Apalachicola	35	11	51	30.01	30.05	-0.05	56.6	-5.0	77	24	64	30	1	49	27	51	47															

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments			Pressure			Temperature of the air										Precipitation			Wind					Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month		
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max. + mean min. -2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of dew point	Mean relative humidity	Total	Departure from normal	Days with 0.01 inch or more	Average hourly velocity	Prevailing direction	Maximum velocity								
																								Miles per hour							Direction	Date
Ohio Valley and Tennessee																																
Chattanooga ¹	762	21	54	29.24	30.07	+0.01	44.2	-7.0	71	22	56	22	2	32	38	33	72	3.61	-9	13	7.6	ne.	35	nw.	4	9	5	17	6.6	T	0.0	
Knoxville ²	995	66	84	28.98	30.06	+0.00	44.0	-4.7	73	22	54	20	18	34	35	36	65	4.13	-9	13	6.7	ne.	26	nw.	3	8	10	13	6.1	T	0.0	
Memphis ²	399	78	86	29.04	30.08	+0.04	47.4	-4.9	73	21	56	23	17	39	25	40	34	67	1.39	-3.9	7	8.9	n.	24	n.	16	5	14	12	6.1	T	0.0
Nashville ²	546	167	187	29.01	30.11	+0.03	44.2	-5.0	71	22	54	19	17	35	33	38	31	67	1.71	-3.4	12	10.2	nw.	32	nw.	16	11	6	14	5.7	T	0.0
Lexington ²	989	6	120	29.01	30.11	+0.06	38.5	-5.2	69	20	49	10	18	28	36	36	27	2.27	-2.0	12	10.2	nw.	32	nw.	16	11	6	14	5.7	T	0.0	
Louisville ²	525	106	120	29.50	30.08	+0.06	40.4	-5.0	68	20	49	12	18	32	33	33	26	64	1.20	-3.2	8	10.2	ne.	37	sw.	3	14	6	11	5.1	T	0.0
Evansville ¹	431	5	38	29.61	30.09	+0.05	40.0	-5.0	68	20	50	14	18	30	35	34	27	65	.89	-3.3	7	10.0	n.	37	w.	11	10	9	12	5.7	T	0.0
Indianapolis ²	823	98	129	29.17	30.08	+0.04	36.4	-3.6	64	20	45	7	18	28	36	30	25	71	1.12	-2.8	8	9.1	n.	31	nw.	16	9	8	14	5.9	T	0.0
Terre Haute ²	575	68	149	29.46	30.10	+0.04	37.6	-3.6	67	20	47	9	18	28	32	32	27	73	1.08	-2.7	8	10.7	nw.	32	sw.	11	9	9	13	6.1	T	0.0
Cincinnati ²	627	11	51	29.39	30.09	+0.04	37.2	-3.7	67	20	47	8	18	28	34	31	25	69	1.13	-2.8	8	8.8	ne.	31	sw.	11	9	9	13	6.1	T	0.0
Columbus ²	822	90	110	29.16	30.07	+0.03	34.8	-3.4	60	20	43	8	17	26	31	28	24	74	.61	-3.9	12	10.4	n.	37	sw.	11	6	8	17	6.8	T	0.0
Dayton ²	900	186	213	29.09	30.08	+0.03	35.0	-3.5	62	20	44	8	17	26	28	29	24	74	.66	-3.0	7	10.8	n.	37	w.	11	10	5	16	6.2	T	0.0
Elkins ²	1,947	61	78	27.95	30.06	+0.01	32.0	-8.0	66	23	43	-2	2	21	45	27	22	72	2.10	-1.7	15	7.3	w.	29	w.	12	6	6	19	7.1	T	0.0
Parkersburg ²	637	77	84	29.36	30.07	+0.02	35.6	-7.2	64	23	46	10	18	26	38	30	24	67	1.26	-2.2	13	7.7	nw.	27	w.	16	8	8	15	6.2	T	0.0
Pittsburgh ¹	842	39	54	29.12	30.04	+0.00	31.4	-8.2	63	23	40	5	18	22	34	27	22	71	1.97	-1.1	12	11.9	nw.	34	nw.	16	7	8	16	6.5	T	0.0
Lower Lake Region																																
Buffalo ²	768	243	280	29.16	30.02	+0.00	26.2	-4.9	52	23	33	3	18	20	27	24	20	78	2.01	-6	16	14.9	w.	56	w.	17	8	9	14	6.2	T	0.0
Canton	448	10	61	29.46	29.95	+0.00	22.6	-5.1	44	24	32	-9	13	13	41	20	16	78	1.57	-9	11	9.6	w.	30	w.	17	12	4	15	5.9	T	0.0
Ithaca	836	77	100	29.27	30.07	+0.04	27.6	-4.2	54	24	36	3	18	19	36	28	25	78	2.08	-4	8	10.4	n.	33	n.	3	7	8	16	6.4	T	0.0
Oswego	335	71	85	29.60	29.90	+0.02	26.6	-4.6	43	16	33	2	18	20	23	24	19	70	1.96	-3	10	9.9	nw.	35	nw.	18	7	6	18	6.7	T	0.0
Rochester ¹	523	5	69	29.01	30.01	+0.01	25.2	-6.6	52	31	34	-4	13	17	22	20	84	2.20	-6	14	12.7	w.	47	sw.	17	8	10	13	6.2	T	0.0	
Syracuse ¹	596	5	51	29.31	29.99	+0.03	26.3	-5.3	48	24	34	0	13	18	33	23	20	82	2.85	-2	14	11.8	sw.	42	w.	18	7	9	15	6.8	T	0.0
Erie ²	714	57	81	29.26	30.06	+0.04	28.8	-4.7	54	31	35	10	17	22	26	25	23	85	1.16	-1.5	11	8.5	nw.	26	sw.	16	10	12	9	5.8	T	0.0
Cleveland ¹	762	27	54	29.21	30.06	+0.03	30.5	-4.1	57	3	37	7	17	24	33	27	23	78	1.28	-1.4	14	14.3	nw.	47	w.	16	7	8	16	6.5	T	0.0
Sandusky	629	5	67	29.37	30.08	+0.05	31.8	-3.3	57	3	39	8	17	24	33	27	23	75	1.41	-1.5	7	9.7	sw.	29	w.	16	7	8	16	6.5	T	0.0
Toledo ²	628	79	87	29.37	30.08	+0.05	31.4	-3.9	56	3	38	7	17	25	31	26	22	76	1.05	-1.7	9	10.2	nw.	32	w.	17	8	10	13	5.8	T	0.0
Fort Wayne ²	857	69	84	29.13	30.08	+0.05	30.4	-3.0	50	3	38	4	17	24	34	27	23	75	1.41	-1.8	6	9.7	nw.	30	nw.	16	6	7	18	6.8	T	0.0
Detroit ¹	730	5	78	29.26	30.08	+0.05	30.4	-3.0	50	3	38	8	17	23	32	26	21	72	1.59	-8	9	9.9	nw.	33	sw.	16	4	14	13	6.6	T	0.0
Upper Lake Region																																
Alpena	609	5	89	29.38	30.07	+0.04	23.6	-1.9	42	14	32	-1	7	15	32	20	15	71	1.73	-1.3	5	11.1	nw.	36	nw.	17	10	8	13	5.7	T	0.0
Escanaba	612	51	72	29.42	30.11	+0.07	24.6	-1.4	47	31	33	1	17	16	28	22	18	77	1.71	-1.2	6	10.4	n.	33	n.	3	7	8	16	6.4	T	0.0
Grand Rapids ²	707	70	74	29.27	30.07	+0.04	30.1	-3.3	52	30	38	6	17	23	28	25	21	78	2.08	-4	8	10.3	n.	34	n.	16	8	10	13	5.8	T	0.0
Lansing	878	5	90	29.11	30.09	+0.02	25.8	-3.7	49	23	36	6	17	20	31	25	22	84	1.67	-7	8	8.5	nw.	29	nw.	17	9	7	15	5.8	T	0.0
Marquette	734	44	73	29.27	30.10	+0.06	25.7	-3.9	45	30	32	1	17	19	30	22	18	75	3.00	-2.0	5	8.5	nw.	32	nw.	16	8	7	16	6.6	T	0.0
Sault Ste. Marie ²	614	11	52	29.35	30.08	+0.05	22.6	-1.0	45	31	31	-6	1	14	35	18	14	76	4.1	-1.4	5	8.0	nw.	35	nw.	17	12	8	11	5.5	T	0.0
Chicago	673	7	131	29.34	30.09	+0.06	32.0	-3.3	54	30	37	1	17	27	31	29	24	72	2.60	0	9	10.0	ne.	33	nw.	16	9	6	16	6.5	T	0.0
Green Bay	617	109	141	29.40	30.10	+0.06	25.9	-2.7	48	30	34	-6	17	18	32	23	19	74	1.34	-7	6	10.4	n.	35	ne.	3	7	4	20	7.0	T	0.0
Milwaukee ¹	681	33	66	29.33	30.10	+0.07	29.3	-2.8	52	30	36	-7	17	22	32	26	22	77	1.82	-6	9	10.8	n.	37	w.	16	5	8	18	7.2	T	0.0
Duluth	1,133	5	47	28.84	30.11	+0.05	24.3	-1.9	42	30	32	-15	17	17	38	21	17	77	1.85	-7	11	12.6	ne.	68	nw.	16	7	6	18	6.8	T	0.0
North Dakota																																
Moorhead, Minn. ²	940	50	58	29.09	30.15	+0.07	24.4	-1.7	56	29	32	-8	17	17	27	24	22	88	1.54	-5	9	8.7	n.	41	w.	15	8	7	16	6.4	T	0.0
Bismarck ¹	1,677	4	41	28.32	30.17	+0.11	26.6	-2.4	64	30	37	-4	16	17	37	24	20	79	1.79	-1	6	11.2	nw.	48	nw.	15	6	9	16	7.0	T	0.0
Devils Lake	1,478	11	44	28.32	30.16	+0.11	20.1	-3.3	47	29	29	-14	17	11	32	19	18	91	1.67	1	6	9.9	n.	42	nw.	15	6	9				
Lemmon, S. Dak.	2,602	4	38	27.33	30.14	+0.20	27.6	-6.5	29	38	-8	16	17	43	26	22	22	94	1.94	1	5	9.9	nw.	42	nw.	15	6	9				
Grand Forks	832	11	71	29.22	30.17	+0.19	26.9	-4.8	29	29	-16	17	10	35	19	17	17	88	1.88	1	8	9.9	nw.	42	nw.	15	6	9				
Williston	1,878	42	50	28.12	30.17	+0.13	26.6	-3.7	67	29	36	-6	16	17	38	24	18	72	1.72	0	5	7.7	se.	35	nw.	15	6	10	12	5.9	T	0.0
Upper Mississippi Valley																																
Minneapolis-St. Paul, Minn. ¹	919	32	61	29.08	30.12	+0.07	28.1	-1.5	61	30	36	-8	17	20	34	25	21	77	1.77	-6	10	10.4	n.	43	nw.	16	8	7	16	6.2	T	0.0
Springfield, Minn.	1,025	4																														

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS—Continued

District and station	Elevation of instruments			Pressure			Temperature of the air										Precipitation			Wind					Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month								
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max. + mean min. - 2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Total	Departure from normal	Days with 0.01 inch or more	Average hourly velocity	Prevailing direction	Maximum velocity											
																								Miles per hour				Direction	Date	Clear days	Partly cloudy days	Cloudy days	0-10	In.	In.
Middle Slope	Ft.	Ft.	Ft.	In.	In.	In.	°F. 40.4	°F. -2.9	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	% 68	In. 1.05	In. -0.2	Miles														
Denver ¹	5,292	106	113	24.69	30.02	+0.07	37.2	-2.1	73	1	47	9	13	28	38	30	23	65	1.01	---	15	7.5	n.	36	n.	9	10	4	17	6.5	10.0	.0			
Pueblo ¹	4,685	5	36	25.25	30.00	+0.08	39.6	-2.0	73	18	52	12	12	28	51	33	25	64	1.09	+1.1	9	9.1	n.	42	n.	9	5	9	17	6.6	12.5	.0			
Concordia ¹	1,392	50	58	28.60	30.12	+0.11	38.5	-2.5	73	31	48	18	17	30	37	33	28	72	1.04	---	5	9.3	n.	26	nw.	10	9	7	10	5.6	10.8	.0			
Dodge City ¹	2,509	10	86	27.42	30.07	+0.10	40.2	-2.6	74	31	51	18	13	29	41	34	29	70	1.82	---	6	11.8	n.	35	n.	9	7	10	14	6.3	8.8	.0			
Wichita ¹	1,353	6	64	28.62	30.09	+0.10	40.6	-4.5	74	31	51	19	17	30	33	35	30	71	1.11	-6.6	8	15.8	s.	43	ne.	16	12	10	9	5.3	8.9	.0			
Oklahoma City ¹	1,214	10	47	28.77	30.08	+0.10	40.2	-3.8	74	31	56	21	17	36	36	39	32	64	1.58	-1.4	7	10.3	n.	29	nw.	9	11	9	11	6.0	11.2	.0			
Chadron, Nebr.	3,439	5	44	26.48	30.10	---	34.6	---	72	18	45	6	16	24	45	30	24	1.02	---	15	---	e.	---	---	---	---	4	9	18	---	11.7	.0			
Southern Slope							49.9	-4.6										66	2.23	+1.4										6.2					
Abilene ¹	1,738	10	56	28.21	30.03	+0.07	51.2	-5.3	79	30	61	28	13	41	36	44	37	68	1.66	+4.4	6	10.8	s.	32	s.	15	10	5	16	6.4	3.1	.0			
Amarillo ¹	3,676	10	49	26.26	30.03	+0.08	43.2	-3.7	83	1	54	20	17	32	43	36	30	70	2.55	+1.8	6	10.5	e.	32	w.	2	12	7	12	5.7	4.5	.0			
Del Rio	960	63	71	29.00	30.00	+0.05	57.6	-5.9	86	31	67	37	9	48	45	50	43	65	1.89	+1.2	7	9.1	se.	24	nw.	10	3	11	17	7.3	.0	.0			
Roswell	3,566	75	85	26.35	29.98	+0.08	47.6	-3.7	80	1	59	27	17	36	45	40	31	60	2.82	+2.1	5	9.3	s.	33	w.	2	8	13	10	5.4	6.6	.0			
Southern Plateau							49.9	-0.1										54	1.88	+1.4										5.1					
El Paso ¹	3,778	82	101	26.14	29.92	+0.04	53.8	-2.0	78	1	65	32	18	42	35	42	30	49	1.63	+1.3	6	9.3	w.	25	sw.	21	13	14	4	4.3	T	.0			
Albuquerque ¹	4,972	5	34	25.00	29.92	---	45.0	-9.7	70	31	57	22	10	33	35	37	29	60	1.00	+6.6	10	9.9	se.	41	nw.	9	9	6	16	6.3	2.0	.0			
Santa Fe ¹	7,013	38	53	23.18	29.98	+0.09	39.0	-7.1	61	31	49	16	10	29	30	33	27	70	1.72	+9.9	12	6.6	s.	31	nw.	9	4	8	19	6.8	10.7	.0			
Flagstaff	6,967	10	59	23.26	29.86	+0.05	37.6	+1.7	60	30	49	14	8	26	44	33	29	30	2.31	---	11	9.0	sw.	34	s.	1	7	17	7	5.3	7.5	.0			
Phoenix ¹	1,107	39	87	28.76	29.92	+0.01	59.8	-9.3	88	28	72	40	16	48	36	50	43	64	4.82	+4.1	9	5.6	e.	29	nw.	4	13	7	11	4.9	.0	.0			
Tucson ¹	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Yuma	142	9	54	29.78	29.93	+0.01	64.8	+7.7	85	19	77	46	3	52	35	53	43	54	1.54	+1.2	6	5.7	n.	29	w.	31	19	8	4	3.0	.0	.0			
Independence	3,957	5	26	25.91	29.95	+0.01	49.6	+1.1	72	23	63	29	3	36	36	39	26	---	1.56	+1.1	4	---	nw.	---	---	---	---	13	7	11	---	T	.0		
Middle Plateau							43.0	+2.1										56	1.44	+0.3										5.0					
Reno ¹	4,527	61	76	25.41	29.98	---	44.3	+3.2	68	16	58	24	24	31	39	34	24	57	2.26	-6.6	4	5.9	w.	25	w.	28	16	10	5	3.7	.6	.0			
Tonopah	6,090	12	20	23.98	29.94	---	42.0	---	62	18	52	24	24	32	27	34	24	---	37	---	6	---	se.	---	---	---	---	13	8	10	---	.3	.0		
Winnemucca	4,339	5	56	25.58	29.98	-0.03	42.5	+2.5	70	27	58	14	15	27	46	34	23	52	4.22	-5.3	3	7.2	ne.	26	sw.	29	13	8	10	4.7	2.1	.0			
Modena	5,473	10	46	29.94	---	-0.02	39.4	+1.2	64	17	53	15	3	26	41	---	---	---	---	---	11	9.1	sw.	27	sw.	19	12	4	5.7	1.5	.0	.0			
Salt Lake City ¹	4,357	86	210	25.57	29.97	-0.01	44.8	+3.1	68	17	54	25	15	36	30	37	29	61	2.33	+4.4	8	7.1	nw.	28	ne.	5	10	9	12	5.4	1.3	.0			
Grand Junction	4,602	60	68	25.32	29.91	-0.03	44.2	+6.6	69	31	54	21	12	34	29	36	27	54	1.70	+9.9	8	6.0	n.	27	sw.	29	10	9	12	5.7	.9	.0			
Northern Plateau							47.2	+5.3										59	0.44	-0.6										5.3					
Baker ¹	3,471	36	54	26.44	30.04	+0.01	42.4	+4.8	67	27	55	19	14	30	36	35	29	68	1.04	-1.1	3	6.7	s.	23	sw.	29	15	4	12	4.7	T	.0			
Boise ¹	2,739	5	49	27.15	30.00	-0.03	45.4	---	73	17	58	20	14	33	35	38	28	54	1.18	---	3	10.9	se.	42	nw.	23	13	6	12	5.0	.0	.0			
Pocatello ¹	4,478	5	31	25.44	30.00	-0.01	39.2	---	64	17	50	15	12	28	36	34	27	63	1.93	---	5	8.3	sw.	34	s.	1	8	11	12	6.0	1.0	.0			
Spokane ¹	1,929	27	42	27.98	30.04	+0.03	45.6	+5.9	72	28	58	23	14	33	36	40	32	61	1.69	-5.7	7	6.3	ne.	34	sw.	17	9	13	9	5.5	.0	.0			
Walla Walla	991	57	65	28.94	30.02	---	50.8	+4.7	73	31	61	26	13	40	31	---	---	---	---	---	9	5.2	s.	28	w.	17	7	13	11	6.0	.0	.0			
Yakima	1,076	58	67	28.87	30.02	---	49.8	+5.7	72	26	62	21	14	37	38	42	30	51	2.4	-1.1	2	5.6	nw.	25	sw.	17	13	9	9	4.5	.0	.0			
North Pacific Coast Region							52.1	+6.7										71	1.91	-2.2										5.8					
North Head	211	5	56	29.76	29.99	-0.02	51.6	+6.4	75	27	57	41	23	46	27	47	43	77	2.07	-3.5	14	12.6	n.	48	s.	17	8	7	16	6.3	.0	.0			
Seattle ¹	125	90	321	29.87	30.01	+0.02	53.1	+8.2	75	11	62	36	14	45	31	46	40	69	1.48	-1.6	9	8.1	n.	31	sw.	17	13	7	11	5.2	.0	.0			
Tacoma	194	172	201	29.79	30.00	---	51.8	+7.6	69	11	60	35	14	43	28	---	---	1.90	-1.7	12	7.1	n.	36	sw.	17	9	11	11	5.7	.0	.0				
Tatoosh Island	86	9	61	29.90	30.00	+0.04	50.3	+7.4	63	10	54	40	19	46	13	47	44	81	3.83	-4.0	14	14.3	e.	42	e.	10	9	5	17	6.5	T	.0			
Medford ¹	1,329	29	58	28.56	29.97	---	50.6	+3.7	76	12	65	29	14	36	44	43	35	62	1.03	-7.9	9	---	---	---	---	---	10	6	15	5.2	.0	.0			
Portland, Oreg. ¹	154	68	106	29.83	30.00	-0.02	54.9	+8.0	76	27	64	36	23	46	30	46	40	68	2.01	-1.9	9	5.7	nw.	20	ne.	12	12	6							

CORRECTED DATA FOR SEPTEMBER 1940

CLIMATOLOGICAL DATA FOR WEATHER BUREAU STATIONS

District and station	Elevation of instruments			Pressure			Temperature of the air										Mean wet thermometer	Mean temperature of the dew point	Mean relative humidity	Precipitation			Wind				Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max. + min. +2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range	Total				Departure from normal	Days with 0.01 inch or more	Average hourly velocity	Prevailing direction	Maximum velocity																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Upper Mississippi Valley	ft.	ft.	ft.	in.	in.	in.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	in.	in.	in.	mi.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

SEVERE LOCAL STORMS

[Compiled by Mary O. Souder from reports submitted by Weather Bureau officials]

[The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Washington, D. C.	7					Snow	The heaviest snow ever recorded in March, 8 inches, measured during this storm. Traffic delayed and thousands of Government workers were forced to walk home. All available snow removal equipment and 1,500 city employees ordered out to clean highways and streets.
Maryland, throughout the State.	7					do	At 10 p. m., 9 inches of snow was measured. Between 5 and 6 p. m., street-cars in all sections of Baltimore, Md., were at a standstill, halted by motorists helplessly skidding on slippery streets. Though not serious, many accidents were reported. Steamer traffic delayed, some dropped anchor until the weather cleared.
New York State, except extreme western portion.	9-11					do	Heavy snow drifted badly; some schools closed; motor traffic delayed.
South Dakota	15	9 p. m.-midnight.				High wind, rain, and snow.	Property damaged; traffic by cars, planes, and trucks hampered badly with some cancellation. High northerly winds and low temperatures continued throughout the day of the 16th.
North Dakota-Minnesota	15-16			32	\$250,000	Blizzard	This storm was centered over northern Minnesota at 6:30 a. m. of the 15th. At 12:30 a. m., of the 16th, the low-pressure area was centered north of Lake Superior. The wind was 12 miles per hour from the southwest at Moorhead, Minn., just before the sudden wind-shift occurred at 9:25 p. m., of the 15th. By 9:30 p. m., the wind had shifted to the northwest and the Fargo airport recorded 46 miles per hour at 9:35 p. m. Extreme wind velocity of 85 miles from the northwest, was recorded at Grand Forks, N. Dak. Snowfall was light. The ground was covered in northern counties with considerable snow from previous storms and the wind caused much drifting, the drifts measuring from 10 to 12 feet in north-central counties. A number of farmers who were out-of-doors collapsed and were frozen to death not far from their homes. Many motorists who were stranded on the highways or went off the road because of poor visibility were found dead from being frozen to death in their stalled cars, from being overcome by carbon monoxide gas, or from sheer exhaustion as they collapsed after abandoning their automobiles to seek shelter. Thousands of birds perished as well as some livestock and much poultry. Small property damage and some damage to overhead wire systems. Thirty-two persons lost their lives in Minnesota. There were many cases of frost bite, some serious enough to require amputation of arms or legs.
Wisconsin	15-17			1		Snow	Strong winds drifted the snow measuring 0.5 to 4.0 inches in the northern portion of the State. Only side roads became impassable and many automobiles were stalled. 3 men, working on stalled cars were injured, 1 fatally, when struck by cars whose drivers were unable to see in the blinding snowstorm.
Michigan	16					do	The storm swept over Michigan from the northwest, accompanied by strong winds and a sudden fall in temperature. Driving hazardous; little property damage reported.
New York State	17-19			9		do	Light to moderate snow accompanied by low temperatures and high winds caused the worst blizzard conditions of the winter. Many main highways blocked, most secondary roads impassable, hundreds of motorists marooned in highways and rural towns, bus schedules canceled and train service delayed. Many schools closed from 1 to 2 days.
Hutchinson, Kans.	31	2 p. m.	17	0	50	Tornado	A vortex was observed. Roofs on several houses damaged; path about 400 yards long.

SOLAR RADIATION AND SUNSPOT DATA FOR MARCH 1941

SOLAR RADIATION OBSERVATIONS

By HELEN CULLINANE

Measurements of solar radiant energy received at the surface of the earth are made at 9 stations maintained by the Weather Bureau and at 10 cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at two Weather Bureau stations (Madison, Wis.; Lincoln, Nebr.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau station at Madison and at Blue Hill Observatory.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Lincoln the observations are made with the Marvin pyrheliometer; at Madison and Blue Hill they are obtained with a recording thermopile, checked by observations with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, their departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Total solar and sky radiation was somewhat above normal at Washington, Madison, Chicago, New York, Twin Falls, and Friday Harbor, and considerably deficient at Lincoln and Fresno.

Normal incidence measurements at Blue Hill Observatory showed a considerable excess in radiation, while at Madison there was an excess in February and a deficiency in March.

No polarization measurements were made during March at either Madison or Blue Hill.

A new cooperating station has been started at State College, Pa., and data from this station will appear regularly in the REVIEW beginning with the April number.

TABLE 1.—Solar radiation intensities during February 1941

[Gram-calories per minute per square centimeter of normal surface]

Madison, Wis.												
Date	Sun's zenith distance											Local mean solar time
	7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.	
	75th mer. time	Air mass										
		A. M.					P. M.					
		e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	
Feb. 18.....	mm. 0.4	cal. 0.98	cal. 1.10	cal. 1.26	cal. 1.42	cal. 1.60	cal. 1.40	cal. 1.40	cal. 1.25	cal. 1.10	mm. 0.7	
Feb. 19.....	0.4	.88	1.03	1.15	1.37	1.58	1.40	1.40	1.25	1.10	0.8	
Feb. 20.....	0.5	.98	1.10	1.22	1.43	1.60	1.42	1.40	1.25	1.10	1.1	
Feb. 25.....	0.9	1.04	1.15	1.28	1.43	1.60	1.42	1.40	1.25	1.10	1.3	
Feb. 28.....	1.4	.96	1.11	1.21	1.39	1.55	1.39	1.40	1.25	1.10	2.0	
Means.....	.97	1.10	1.22	1.40	1.58	1.40	(1.25)	1.40	1.25	1.10	-----	
Departures.....	-.02	+.03	+.02	+.03	+.05	+.07	+.08	-----	-----	-----	-----	

Solar radiation intensities during March 1941

Madison, Wis.												
Mar. 4.....	1.2	.96	1.06	1.16	1.37	1.65	-----	-----	-----	-----	-----	1.9
Mar. 5.....	1.6	.80	.92	1.06	1.26	1.62	1.38	-----	-----	-----	-----	2.2
Mar. 7.....	2.0	.87	.92	1.04	1.30	1.55	-----	-----	-----	-----	-----	2.9
Mar. 13.....	1.3	.99	1.15	1.26	1.42	1.55	1.43	-----	-----	-----	-----	2.9
Mar. 14.....	1.1	.92	1.06	1.21	1.37	1.55	1.38	-----	-----	-----	-----	2.7
Mar. 17.....	0.4	1.03	1.14	1.30	1.46	1.64	-----	-----	-----	-----	-----	0.7
Mar. 18.....	0.6	.94	1.03	-----	-----	-----	-----	-----	-----	-----	-----	1.3
Mar. 21.....	2.2	.68	.79	1.04	1.21	1.48	-----	-----	-----	-----	-----	2.6
Mar. 22.....	3.0	.47	.61	.81	1.15	-----	-----	-----	-----	-----	-----	3.4
Mar. 28.....	3.6	-----	-----	-----	1.16	1.55	-----	-----	-----	-----	-----	3.4
Mar. 29.....	2.3	.57	.62	.77	.92	1.38	-----	-----	-----	-----	-----	3.0
Means.....	.82	.93	1.07	1.26	1.55	1.40	-----	-----	-----	-----	-----	-----
Departures.....	-.06	-.07	-.07	-.05	-.01	+.10	-----	-----	-----	-----	-----	-----

Blue Hill Observatory												
Mar. 2.....	2.8	0.98	1.08	1.20	1.35	-----	1.36	1.26	1.14	1.04	-----	2.4
Mar. 5.....	1.5	1.04	1.14	1.20	1.38	-----	1.38	1.22	1.06	.96	-----	1.5
Mar. 6.....	1.8	.81	.93	1.11	-----	-----	-----	-----	-----	-----	-----	2.0
Mar. 10.....	2.2	1.00	1.10	1.22	1.34	-----	-----	-----	-----	-----	-----	2.6
Mar. 13.....	1.5	1.06	1.17	1.27	1.40	-----	1.36	1.22	1.09	.98	-----	1.1
Mar. 14.....	1.5	1.03	1.11	1.22	1.34	-----	1.26	1.11	-----	-----	-----	1.9
Mar. 20.....	1.4	-----	-----	-----	-----	-----	-----	1.19	1.06	.96	-----	1.5
Mar. 21.....	1.5	-----	-----	1.14	1.28	-----	1.31	1.15	-----	-----	-----	2.1
Mar. 22.....	2.1	-----	1.13	1.22	1.36	-----	1.28	1.16	1.04	.96	-----	2.5
Mar. 23.....	2.5	.94	1.03	1.15	1.30	1.49	1.31	1.14	1.00	.88	-----	2.8
Mar. 26.....	2.9	.83	.96	1.09	1.29	1.50	1.28	-----	-----	-----	-----	2.3
Mar. 27.....	2.9	.70	.81	.97	-----	-----	-----	-----	-----	-----	-----	3.2
Mar. 31.....	1.6	.90	1.00	-----	1.26	-----	-----	-----	.77	-----	-----	1.0
Means.....	.93	1.04	1.16	1.33	(1.50)	1.32	1.18	1.02	.96	-----	-----	-----
Departures.....	+.03	+.06	+.06	+.09	+.07	+.08	+.09	+.05	+.08	-----	-----	-----

*Extrapolated.

TABLE 2.—Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface

[Gram-calories per square centimeter]

Week beginning—	Wash- ington	Madison	Lincoln	Chicago	New York	Fresno	Cam- bridge	Fair- banks	Twin Falls	La Jolla	New- port	New Orleans	River- side	Blue Hill	Albu- querque	Friday Harbor
Feb. 26.....	cal. 284	cal. 261	cal. 269	cal. 197	cal. 318	cal. 145	cal. 243	cal. 131	cal. 262	cal. 328	cal. 268	cal. 384	cal. 240	cal. 227	cal. 498	cal. 195
Mar. 5.....	279	231	263	267	258	449	255	108	436	412	281	316	438	268	461	323
Mar. 12.....	397	454	392	307	356	351	342	216	472	365	371	277	316	360	390	286
Mar. 19.....	377	393	309	367	464	510	370	235	395	487	401	251	473	383	399	350
Mar. 26.....	398	347	376	271	458	410	428	229	377	453	449	481	404	441	618	343

DEPARTURES FROM WEEKLY NORMALS

Feb. 26.....	+3	-9	-48	-1	+90	-118	-18	-8	-8	-65	-14	+112	-128	-74	+57	+28
Mar. 5.....	-32	-70	-68	+50	0	+46	-19	-48	+111	+15	-19	-9	+14	-26	+9	+104
Mar. 12.....	+76	+131	+22	+69	+87	-65	+15	+15	+137	-29	+15	-71	-95	+46	-20	+75
Mar. 19.....	+32	+65	-80	+108	+143	+56	-8	+24	+1	+66	-5	-106	+91	-11	-63	+66
Mar. 26.....	+50	-9	-4	+17	+66	-56	+18	-55	+26	-14	+34	+147	+21	+54	+90	+28

ACCUMULATED DEPARTURES ON APRIL 1, 1941

	+2,051	+1,120	-3,331	+2,063	+5,012	-2,618	+7	-392	+1,799	-1,428	+175	+1,743	-3,577	-532	+511	+3,451
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PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR
FEBRUARY 1941[Based on observations at Zurich and Locarno. Data furnished through the courtesy of
Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

February 1941	Relative numbers	February 1941	Relative numbers	February 1941	Relative numbers
1.....	*a 75	11.....	36	21.....	d 40
2.....	69	12.....	30	22.....	26
3.....	a 65	13.....		23.....	15
4.....		14.....	29	24.....	Ecd 46
5.....	Mcd 85	15.....	a 27	25.....	54
6.....	a 64	16.....	8?	26.....	46
7.....	57	17.....	21	27.....	b 50
8.....	43	18.....	22	28.....	*ad 56
9.....	d 58	19.....	Wc 28		
10.....	47	20.....			

Mean, 25 days=43.9

* = Observed at Locarno.

a = Passage of an average-sized group through the central meridian.

b = Passage of a large group through the central meridian.

c = New formation of a group developing into a middle-sized or large center of activity:

E, on the eastern part of the sun's disk; W, on the western part; M, in the central-circle zone.

d = Entrance of a large or average-sized center of activity on the east limb.

STATION: [Illegible] (Elev. [Illegible] Feet)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
High Temp	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0	80.0	75.0	70.0	65.0	70.0
Low Temp	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	60.0	55.0	50.0	45.0	50.0
Precipitation	4.0	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Relative Humidity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Wind Speed	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Clouds	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Thunderstorms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days	31	28	31	30	31	30	31	31	30	31	30	31	365

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
High Temp	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0	80.0	75.0	70.0	65.0	70.0
Low Temp	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	60.0	55.0	50.0	45.0	50.0
Precipitation	4.0	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Relative Humidity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Wind Speed	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Clouds	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Thunderstorms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days	31	28	31	30	31	30	31	31	30	31	30	31	365

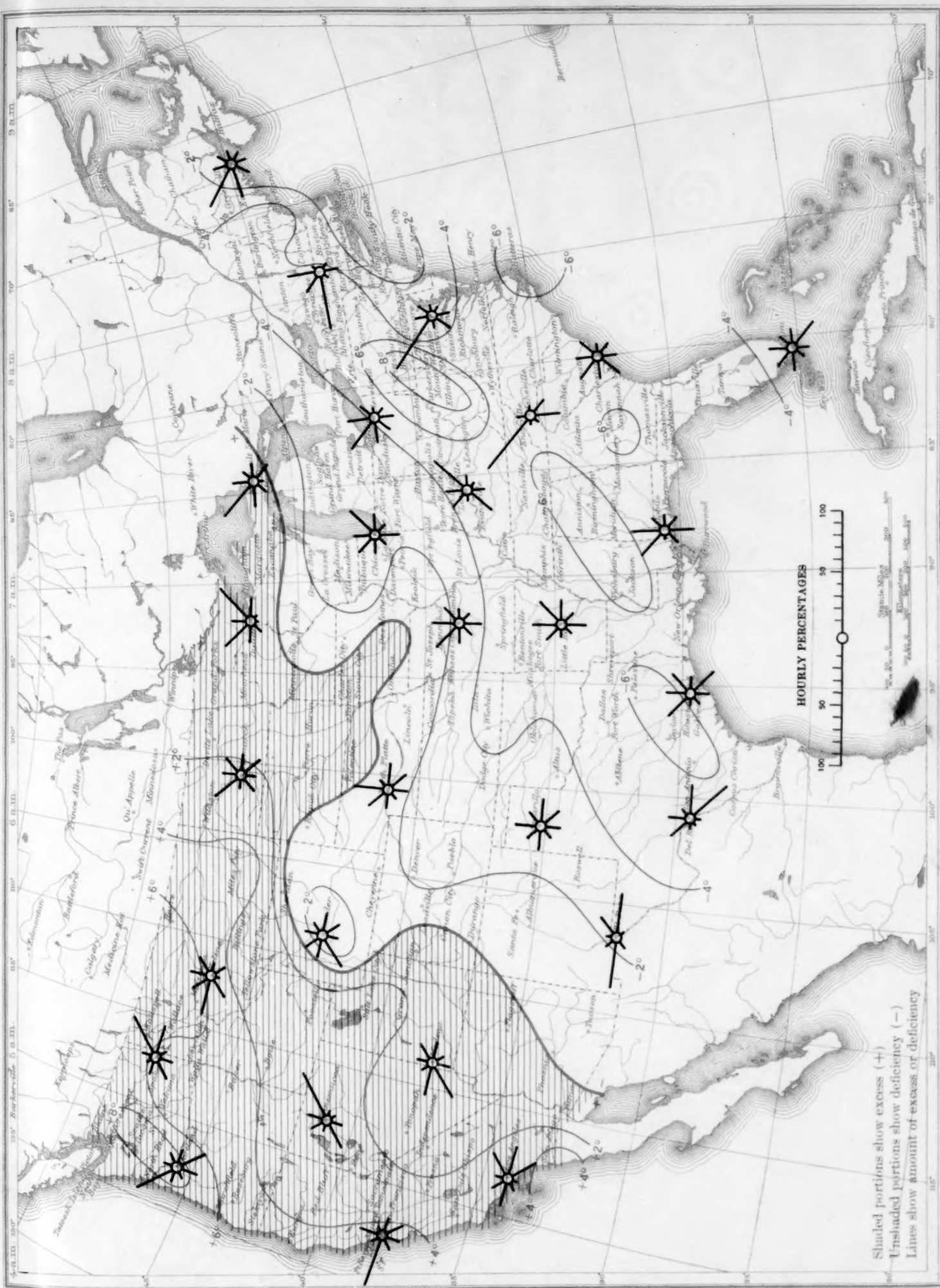
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
High Temp	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0	80.0	75.0	70.0	65.0	70.0
Low Temp	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	60.0	55.0	50.0	45.0	50.0
Precipitation	4.0	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Relative Humidity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Wind Speed	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Clouds	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Thunderstorms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days	31	28	31	30	31	30	31	31	30	31	30	31	365

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
High Temp	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0	80.0	75.0	70.0	65.0	70.0
Low Temp	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	60.0	55.0	50.0	45.0	50.0
Precipitation	4.0	3.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Relative Humidity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Wind Speed	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Clouds	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Thunderstorms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days	31	28	31	30	31	30	31	31	30	31	30	31	365

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
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Relative Humidity	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Wind Speed	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Clouds	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Thunderstorms	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Days	31	28	31	30	31	30	31	31	30	31	30	31	365

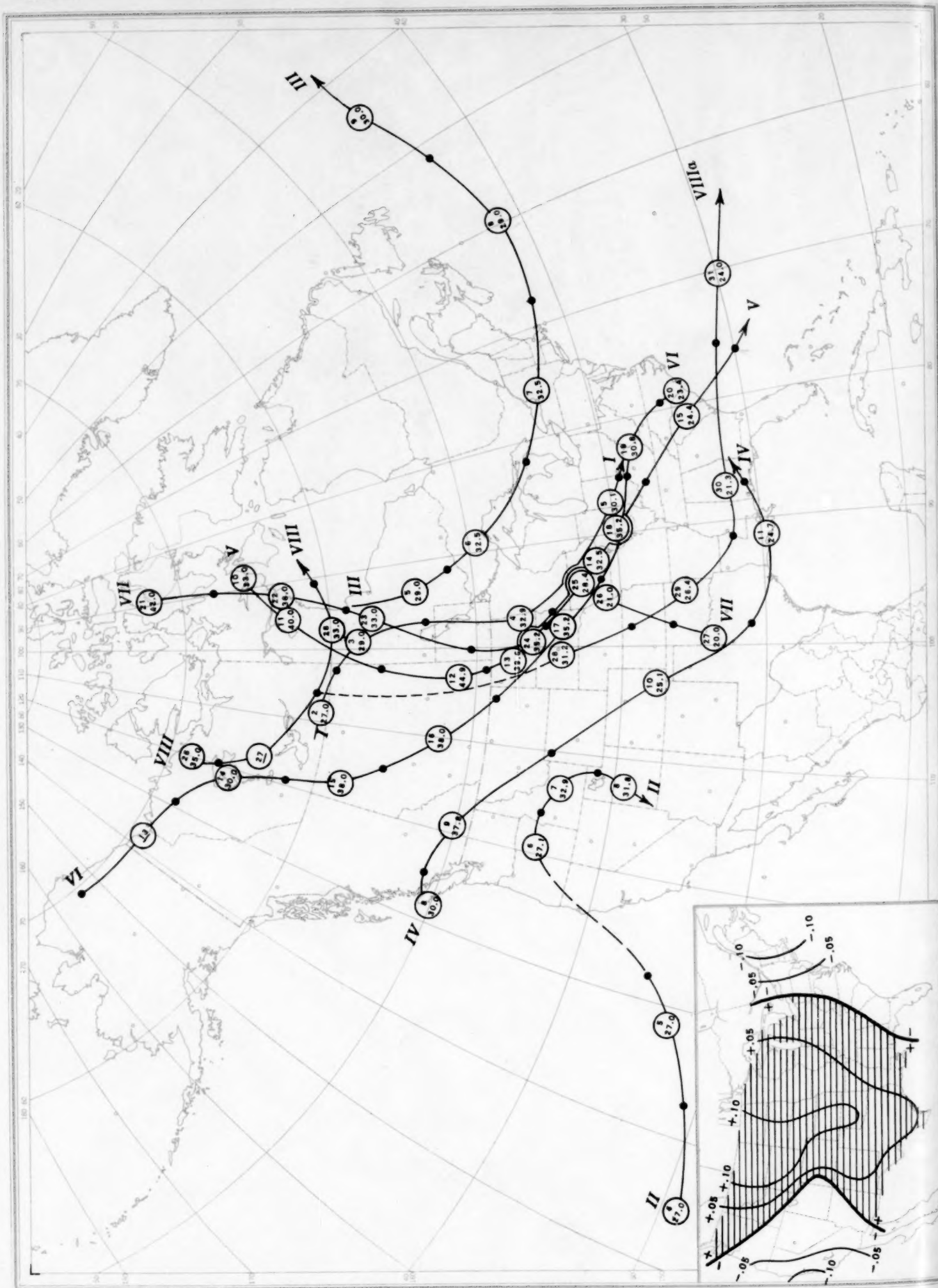
Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, March 1941

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, March 1941



Shaded portions show excess (+)
Unshaded portions show deficiency (-)
Lines show amount of excess or deficiency

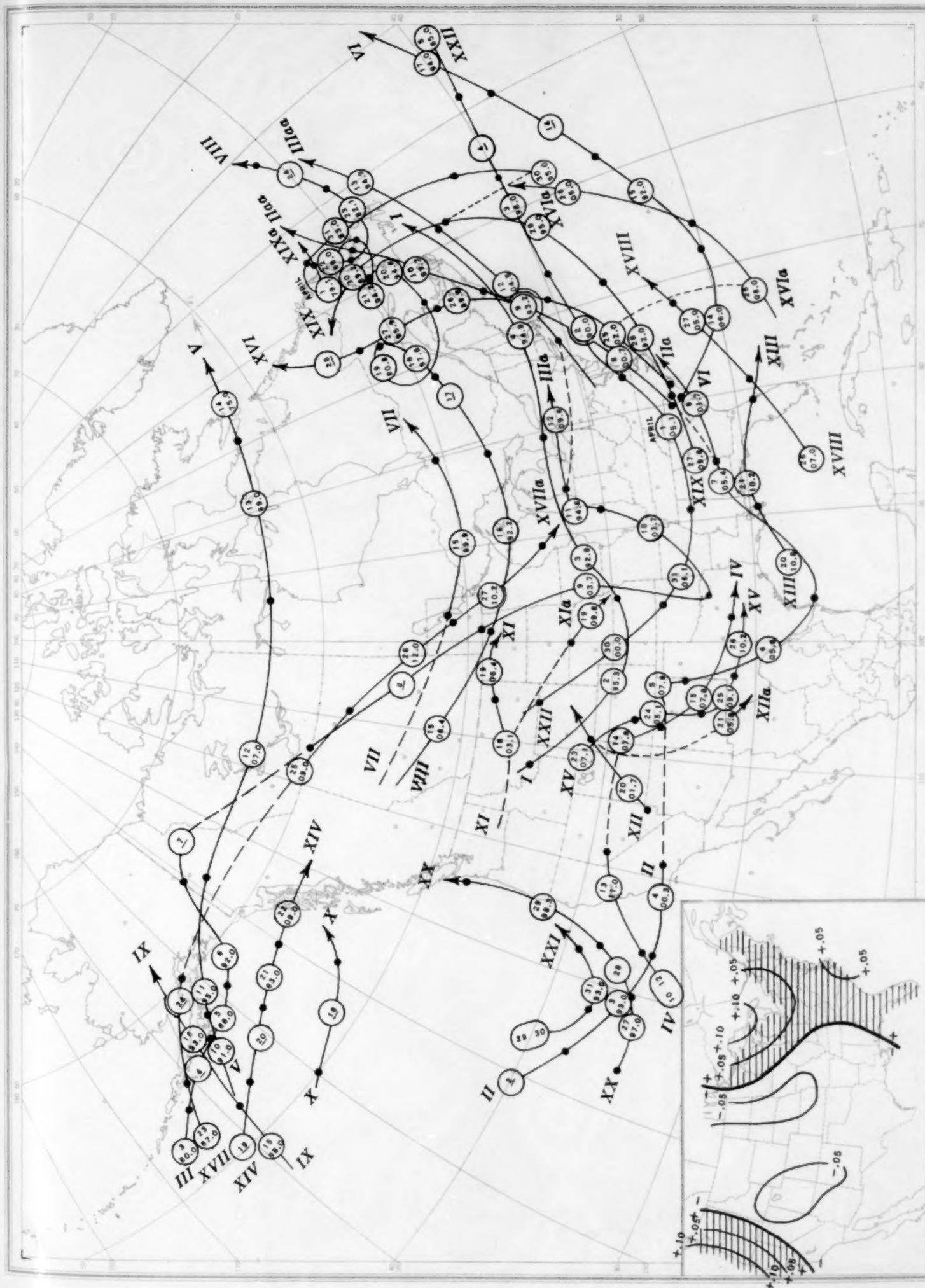
Chart II. Tracks of Centers of Anticyclones, March 1941. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, March 1941. (Inset) Change in Mean Pressure from Preceding Month

Chart III. Tracks of Centers of Cyclones, March 1941. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, March 1941

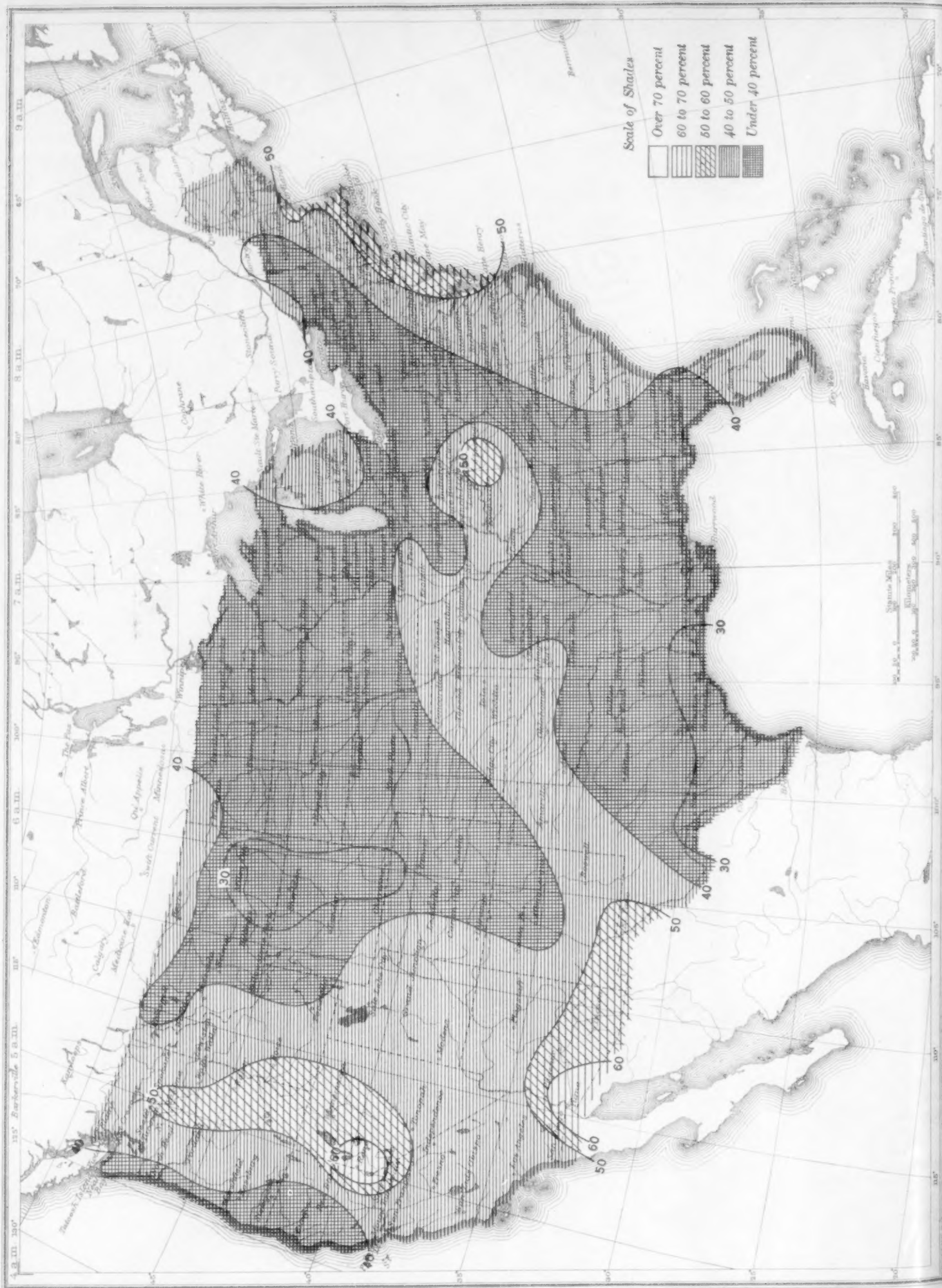


Chart V. Total Precipitation, Inches, March 1941. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, March 1941. (Inset) Departure of Precipitation from Normal

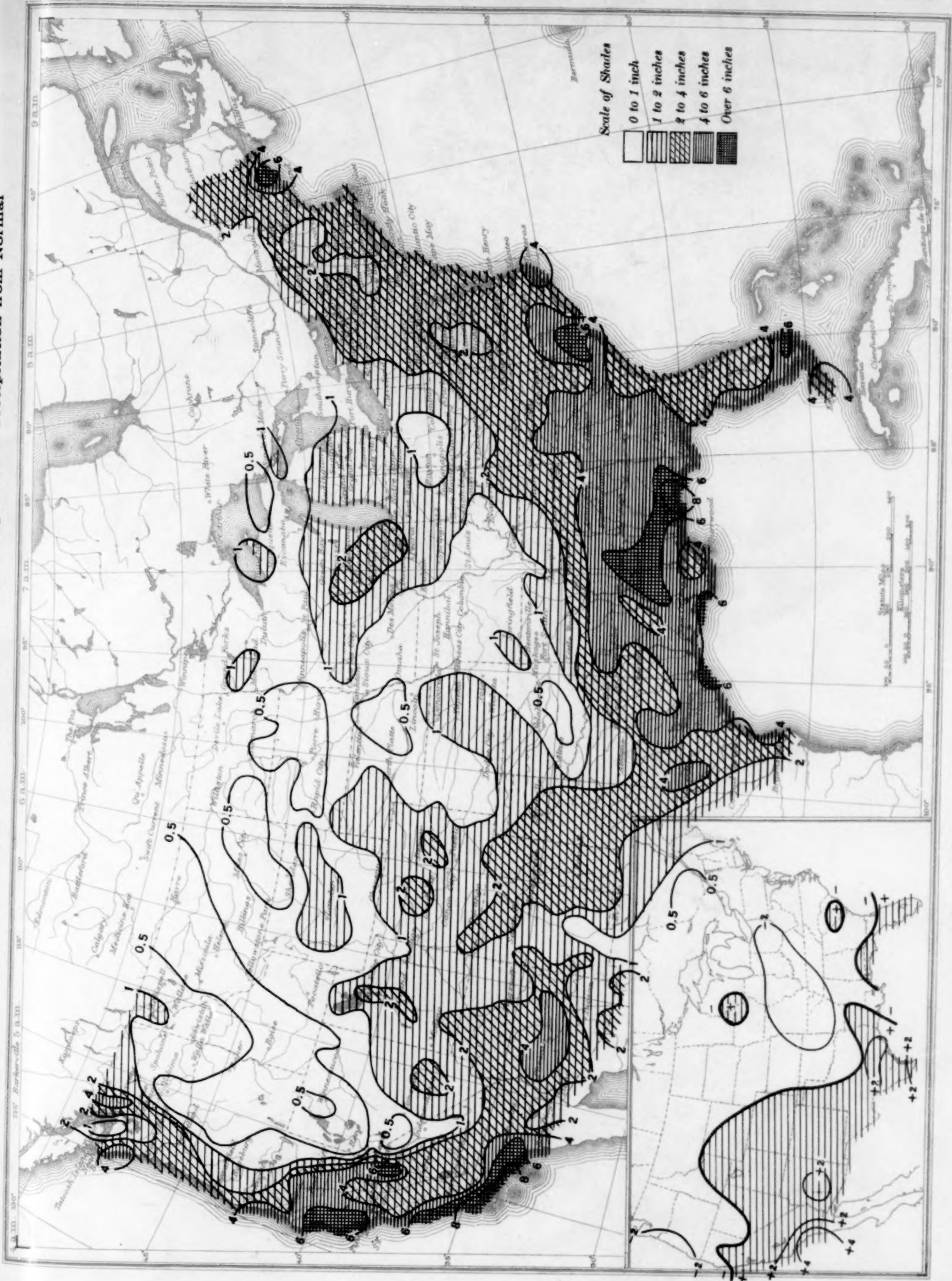


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, March 1941

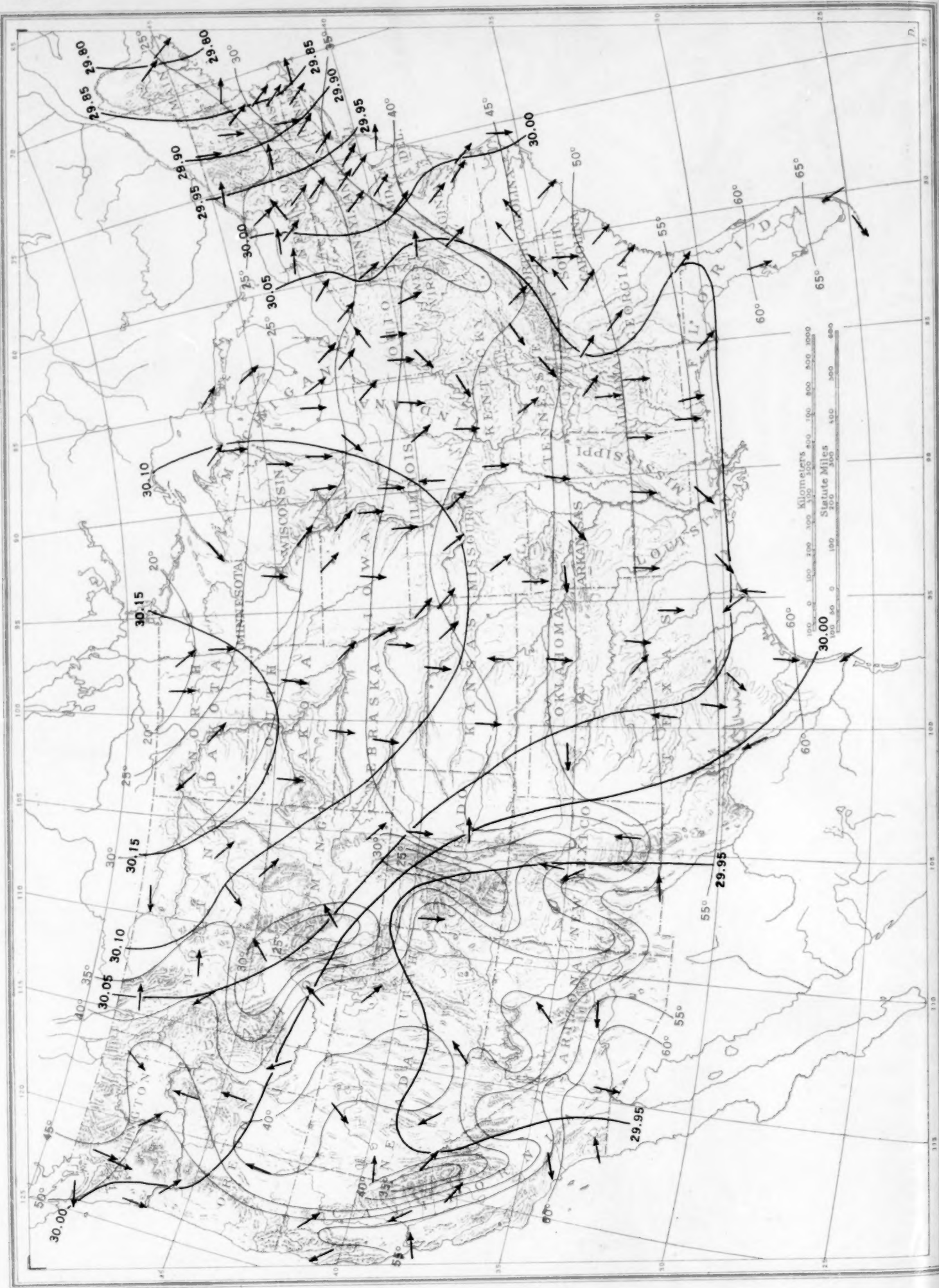


Chart VII. Total Snowfall, Inches, March 1941. (Inset) Depth of Snow on the Ground at 7:30 p.m., Monday, March 24, 1941

Chart VII. Total Snowfall, Inches, March 1941. (Inset) Depth of Snow on the Ground at 7:30 p.m., Monday, March 24, 1941



Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms ($^{\circ}\text{C.}$) and Resultant Winds for 1,500 Meters (m. s. l.) March 1941
 Isotherms and isobars based on radiosonde observations at 12:30 a. m. (E. S. T.) and winds based on pilot-balloon observations at 5:00 a. m. (E. S. T.).

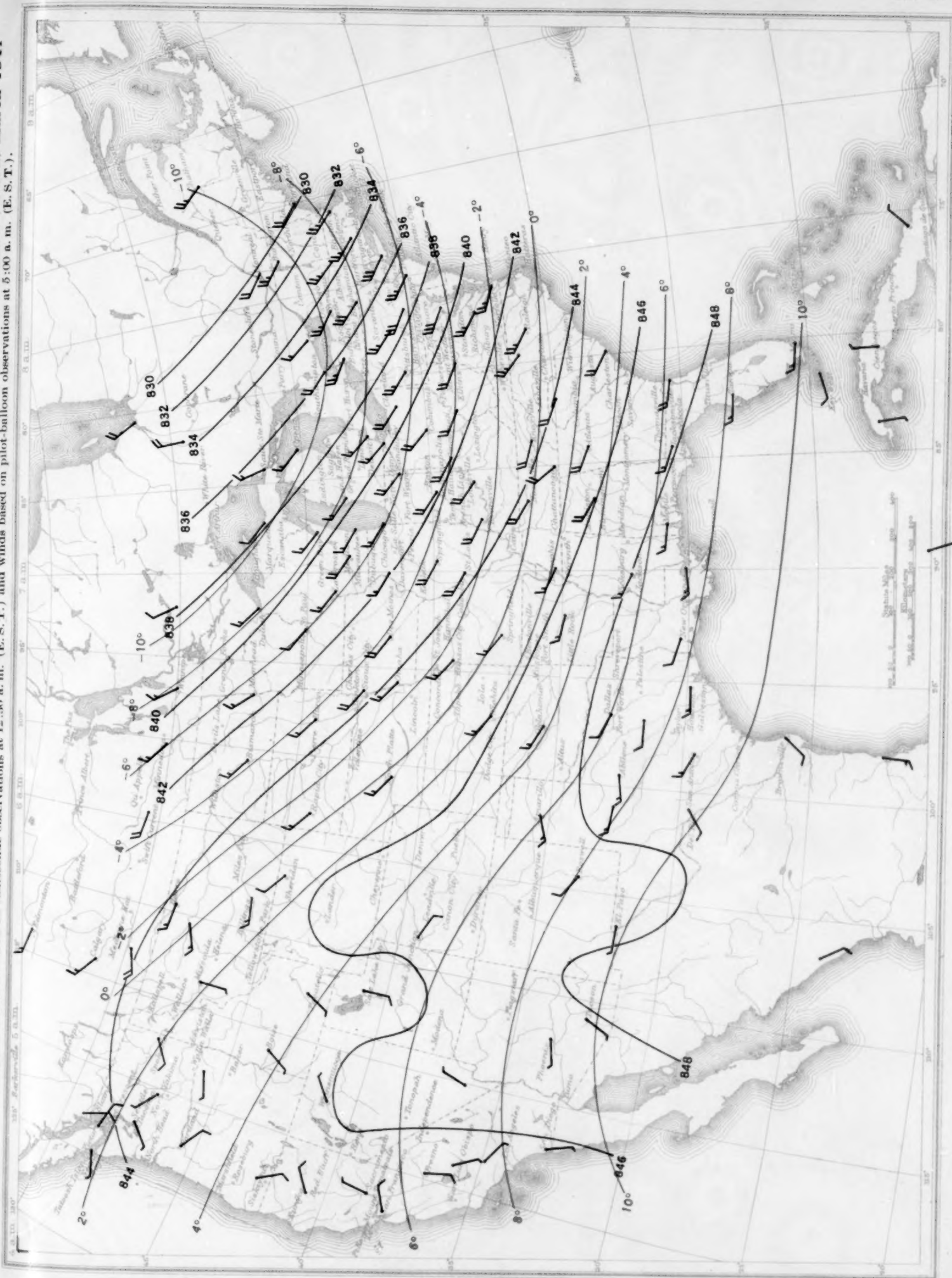


Chart IX. Isobars (mb) Isotherms ($^{\circ}\text{C}$) 1:00 a.m. (E.S.T) and Resultant Winds 5:00 a.m. (E.S.T.) for 3,000 Meters (m.s.l.) March 1941

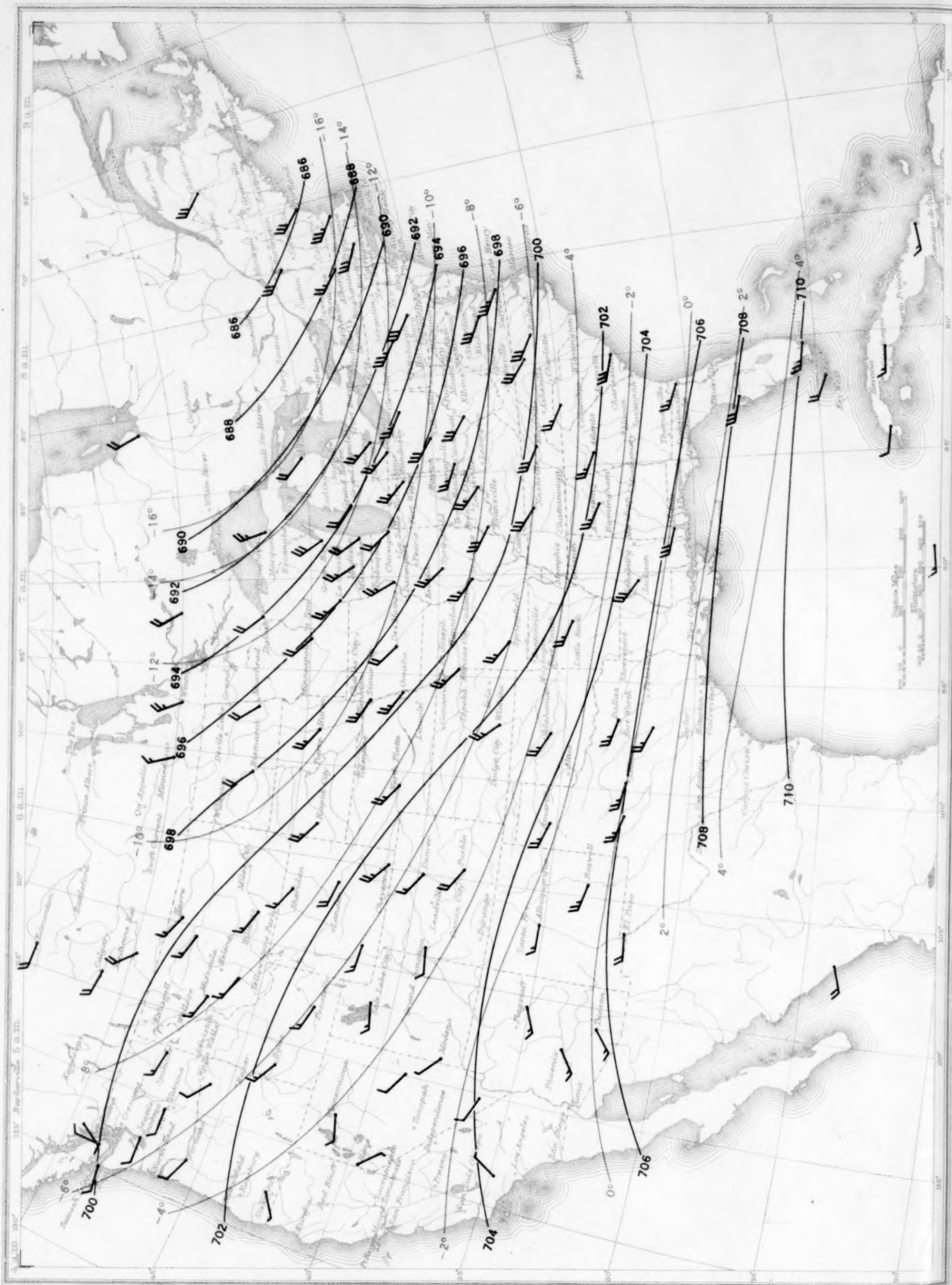


Chart X. Isobars (mb) Isotherms ($^{\circ}\text{C}$) 1:00 p.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) March 1941

Chart X. Isobars (mb) Isotherms (°C.) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 5,000 Meters (m.s.l.) March 1941

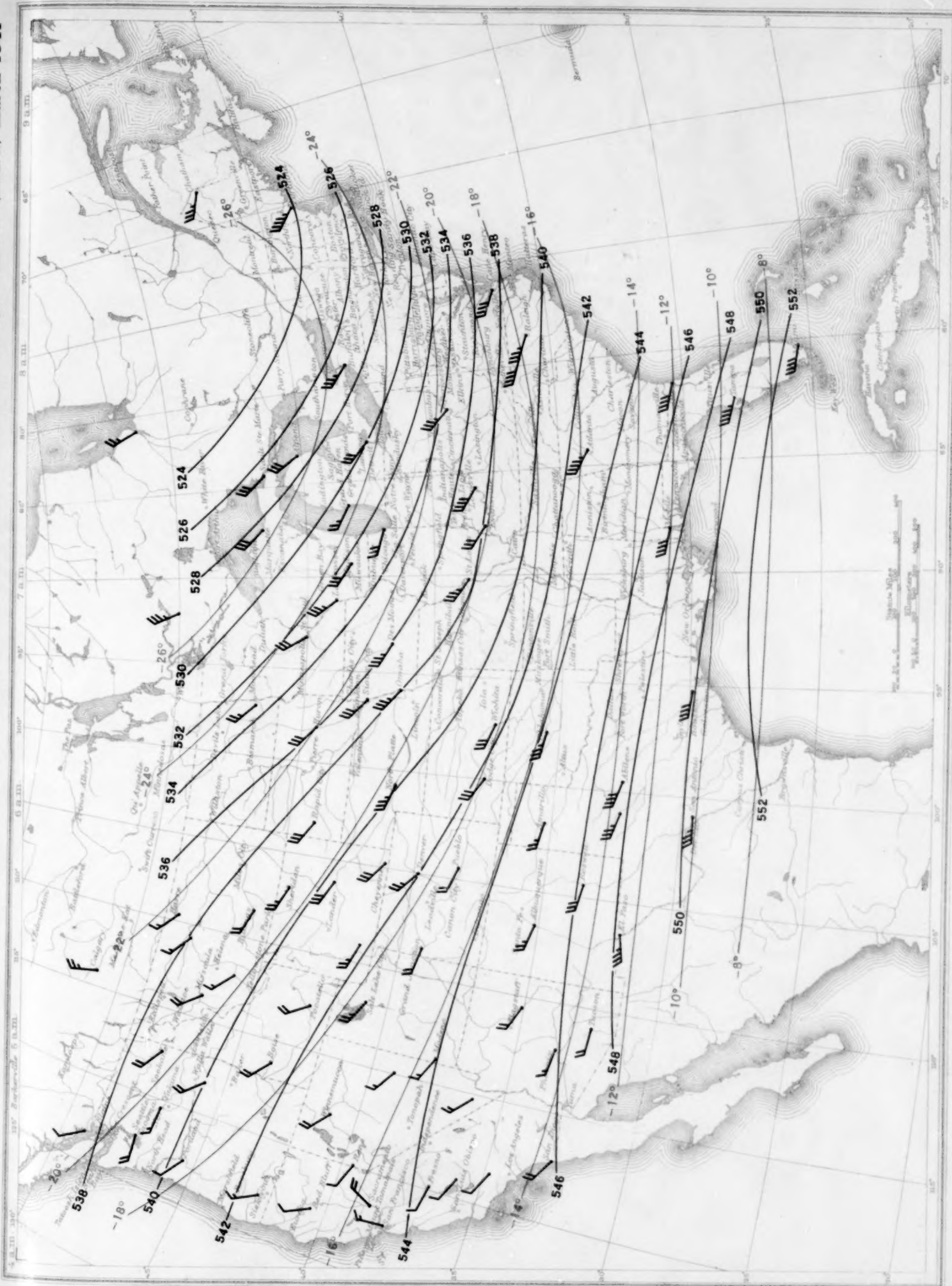


Chart XI. Isobars (mb) Isotherms ($^{\circ}\text{C}$) 1:00 a.m. (E.S.T.) and Resultant Winds 5:00 p.m. (E.S.T.) for 10,000 Meters (m.s.l.) March 1941

